BM-2100

A220

Serial No. 10,228 and later

AEP Model
UK Model
US Model
E Model

TELECINE CORDER

SPECIFICATIONS

GENERAL

Type of Unit: Claw pull-down
Single blade shutter

Film Type: 8 mm, super or single 8 and regular 8

Television Standard: Both 60 fields and 50 fields
(NTSC, PAL and SECAM)

Film Transport: Power sprocket and capstan drive

Projection Speed: Still and pause
18 or 24 frames/sec. with fine adjustment of −4 to +1 frames/sec. for super or single 8, and 15.5 to 21 frames/sec. variably adjusted for regular 8 (with the 18 button depressed)
Variable 6 to 40 frames/sec. for super or single 8, and 7 to 48 frames/sec. for regular 8, continuously controllable

Tape-synchronize System: 1 pulse/frame or 1 tone burst/frame

Sync Pulse Input: SYNC PULSE IN; minijack 2 V(p-p)

Automatic Film Stop: Automatic film stop possible by attaching foil between perforations (not displayed in the picture) at desired spot on film.

Reel Size: Up to 230 mm (9 inches) dia.

Film Threading: Simple, straight forward, from supply reel through mechanism and sound system to take-up reel
Automatic loop former system

Remote Control: 8-pin DIN receptacle

Power Requirements: European model: 220 V ac, 50 Hz
UK model: 240 V ac, 50 Hz
U.S.A., Canadian model: 120 V ac, 60 Hz
Model for other countries: 120 or 220 V ac, 50/60 Hz

Power Consumption: U.S.A. model: 75 W
Other models: 95 W

Dimensions: Approx. 357 (w) x 428 (h) x 200 (d) mm
14 1/16 (w) x 16 7/8 (h) x 7 7/8 (d) inches
including projecting parts and controls

Weight: Approx. 13.57 kg (29 lb 15 oz)

— Contined on page 2 —

SAFETY-RELATED COMPONENT WARNING!!

COMPONENTS IDENTIFIED BY SHADING AND MARK ⚠ ON THE SCHEMATIC DIAGRAMS, EXPLODED VIEWS AND IN THE PARTS LIST ARE CRITICAL TO SAFE OPERATION. REPLACE THESE COMPONENTS WITH SONY PARTS WHOSE PART NUMBERS APPEAR AS SHOWN IN THIS MANUAL OR IN SUPPLEMENTS PUBLISHED BY SONY.

SONY®

SERVICE MANUAL

SOUND SYSTEM

Film Transport:	Two pinch rollers and flywheels for each side of the sound head
Sound Track:	Magnetic
Picture/Sound Distance:	18 frames
Audio Output:	AUDIO OUT; phone jack Level: −5 dB Monaural
Frequency Response:	50 Hz to 5 kHz ±2 dB (SMPTE ms8 mfB Reference Film)
Total Harmonic Distortion:	Less than 2.0 % at 400 Hz
Signal-to-noise Ratio:	Better than 40 dB (SMPTE Reference Film)
Wow and Flutter:	0.35 % (WRMS) (except for use with the Remote Control Unit)

VIDEO

Input:	VIDEO IN; BNC connector 1 V ±50 %, 75 Ω, unbalanced
Output:	VIDEO OUT; BNC connector same as VIDEO IN

OPTICAL

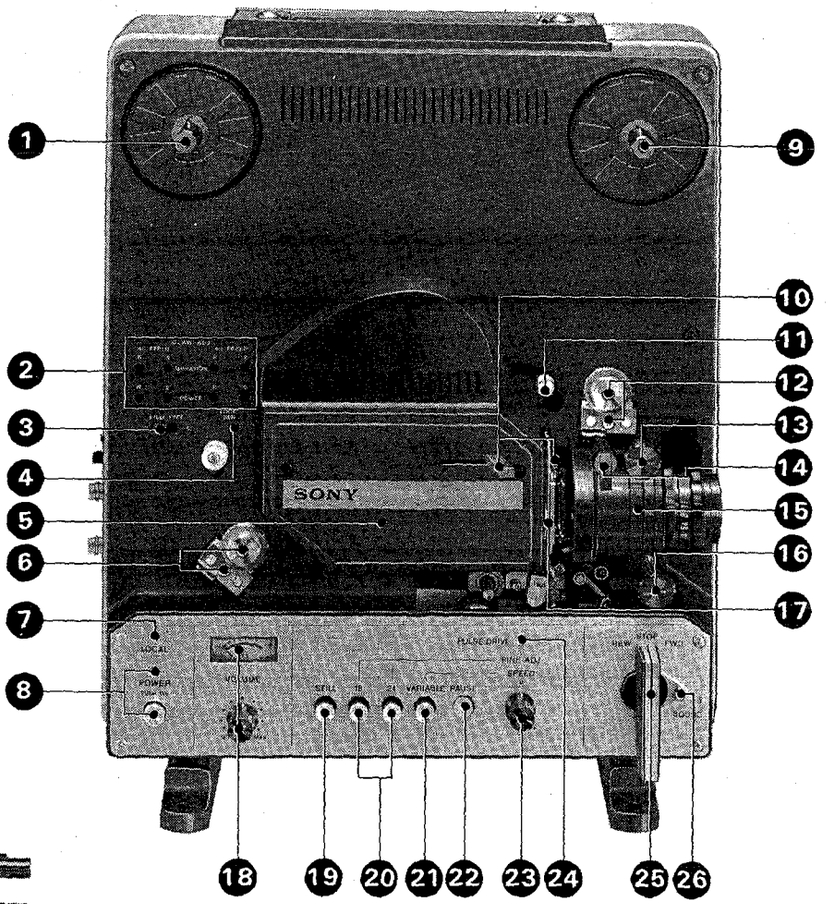
Lamp:	12 V, 50 W halogen JC type lamp Parabolic mirror (adjustable) Glass diffuser
Lens Mount:	C-mount
Projection Lens:	f4, 50 mm, with lens cap, supplied Framing adjustment ring (for video cameras equipped with a 2/3 inch pick-up tube), supplied
Accessories Supplied:	AC power cord (1) Sprockets for regular 8 (2) Film locking shoes for regular 8 (black) (2) Connecting cord RK-118 (phone plug to miniplug (2 m) (1) Plug Adaptor PC-5H or PC-5A (phone plug to minijack) (1) 75 Ω coaxial cable with BNC connectors (2 m) (1) Frosted glass diffuser (1) Dust cover (1)

SECTION 1
OUTLINE

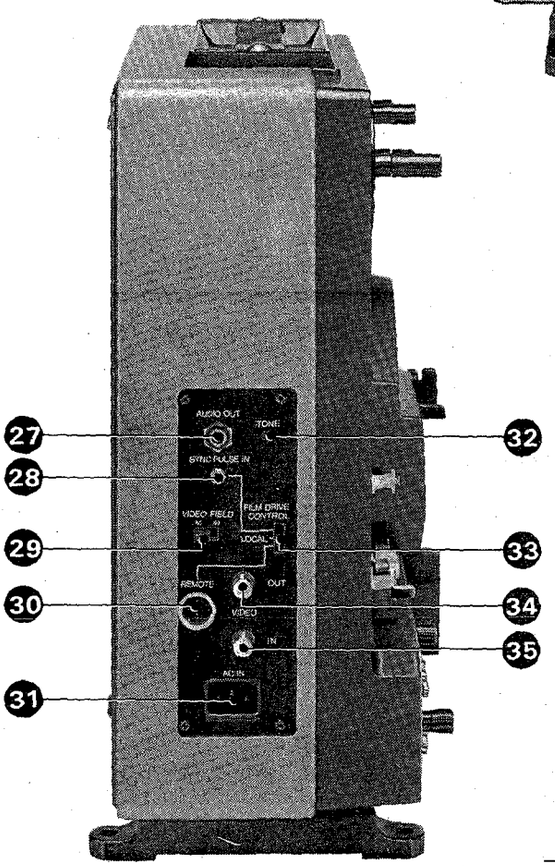
1-1. GENERAL DESCRIPTION

LOCATION AND FUNCTION OF CONTROLS

Left side



Rear



❶ **Take-up Reel Spindle with Reel Lock**

❷ **Claw Adjustment Controls [CLAW ADJ]**: These controls adjust the pull-down movement of the claw for stable picture.

DURATION Controls: These controls adjust the duration during which the claw protrudes to pull down a film frame.

POWER Controls: These controls adjust the amount of protrusion of the claw.

❸ **FILM TYPE Selector**

R: for regular-8 films

S: for super-8 and single-8 films

❹ **Loop Sensor Control [LOOP SEN]**: Adjusts the luminosity of the LED for detecting a film loop by the phototransistor.

❺ **Lamp Housing Cover**

❻ **Take-up Sprocket and Film Locking Shoe**

❼ **LOCAL Control Indicator**: Lights up when the FILM DRIVE CONTROL selector is set to LOCAL.

❽ **POWER Switch and Pilot Lamp**: Depress to turn on the unit. The Pilot Lamp will light up. To turn off, depress again.

❾ **Supply Reel Spindle with Reel Lock**

❿ **Film Gate Pressure Holder and Film Gate Locking Lever**: Pass the film between the film gate and the holder, and set the lever to the extreme left to lock the film in place.

⓫ **Tension Roller**

⓬ **Feed Sprocket and Film Locking Shoe**

⓭ **Framing Control**: Turn to adjust the framing in the vertical direction.

⓮ **Focus Lock Knob**: Turn 180° counterclockwise for adjusting focus. Turn 180° clockwise to lock after the image is precisely focused on the monitor.

⓯ **Lens Mount (C-mount), Framing Adjustment Ring, and Projector Lens**: Remove the Framing Adjustment Ring when the unit is to be used with a video camera equipped with a 1 inch pickup tube. When the unit is to be used with a video camera equipped with a $^2/_3$ inch pickup tube, the Framing Adjustment Ring is necessary.

⓰ **Focus Control**: Unlock the Focus Lock Knob ⓮ by turning it 180° counterclockwise, and turn the control to adjust focus.

⓱ **Film Gate Format Change Lever**: Set to S (upper position) for super-8 and single-8 films, and to R (lower position) for regular-8 films.

⓲ **VOLUME Control and Level Meter**: Turn clockwise to increase the playback sound volume. The meter shows the playback level of the sound.

⓳ **STILL Button**: Depress for still picture projection. To release the button, depress the 18 or 24 button (see ⓴ below).

⓴ **Projection Speed Selector Buttons [18] [24]**: Depress the 18 button for projection at a speed of 18 frames/sec., and the 24 button for projection at a speed of 24 frames/sec.

㉑ **VARIABLE Speed Control Selector Button**: Depress for variable control of projection speed (see ㉓ below).

㉒ **PAUSE Button**: Keep depressed to stop the film momentarily. A still picture will be obtained on the monitor while the button is being depressed. When the button is released, the film will run again.

㉓ **Fine Adjustment/Speed Control [FINE ADJ/SPEED]**: Normally set the control to "0" (center position). When the 18 or 24 button is depressed, fine adjustment of the speed is possible. When the VARIABLE speed control selector button is depressed, the projection speed can be controlled variably from slow-motion to fast-speed projection.

㉔ **PULSE DRIVE Indicator**: Lights up when the FILM DRIVE CONTROL selector is set to SYNC PULSE IN. It flickers when pulse signals of a proper level are supplied from a tape recorder.

㉕ **Function Lever**

FWD: for projecting a film.

STOP: for stopping the film. Be sure to set the lever to STOP when the unit is not in use.

REW: for rewinding the film.

㉖ **Sound Pad Stopper Release Lever**: Push down when a film with magnetic sound track(s) is projected.

㉗ **Audio Output Jack [AUDIO OUT]** (phone jack): For balanced output, use a connecting cord with a stereo binaural plug.

㉘ **Sync Pulse Input Jack [SYNC PULSE IN]** (minijack)

㉙ **VIDEO FIELD Selector**: Selects the TV scanning system.

50: for a 50-field system

60: for a 60-field system

㉚ **REMOTE Control Connector** (8-pin DIN connector)

㉛ **AC Input Socket [AC IN]**

㉜ **TONE Control**: Turn clockwise for more treble or counterclockwise for less treble with a small screwdriver.

㉝ **FILM DRIVE CONTROL Selector**

SYNC PULSE IN: for controlling the film drive by the pulse signals supplied from a tape recorder.

LOCAL: for controlling the film drive with this unit.

REMOTE: for controlling the film drive with the RM-210 Remote Control Unit.

㉞ **Video Output Connector [VIDEO OUT]** (BNC connector)

㉟ **Video Input Connector [VIDEO IN]** (BNC connector): Connect the video signal (or vertical drive pulse) from the camera.

INSTALLATION AND CONNECTIONS

INSTALLATION

Use the MVS-210 Mounting Plate for optimum installation and positioning of the unit, video camera and slide projector. Use of the Sony DXC-1600 series Color Video Camera (optional) is recommended.*

❶ Mount the camera onto the mounting plate upside down. For details, refer to the instuructions of the MVS210.

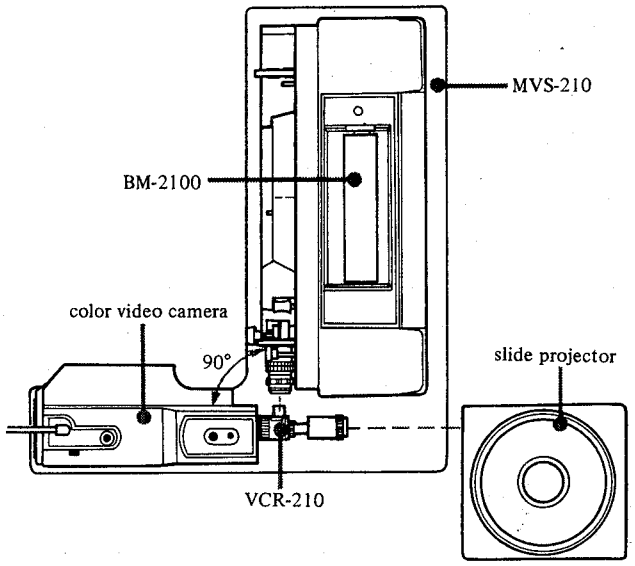
❷ Remove the zoom lens from the camera, and mount the VCR-210 Beam Splitter into the lens mount. Attach a 100 - 105 mm enlarging lens to the Focusing Barrel of the VCR-210. If a slide projector is not to be used, remove the long barrel with the Focusing Barrel by turning the knurled ring, and put the dust cap in place. For details, refer to the instructions of the VCR-210.

❸ Set the BM-2100 Telecinecorder on the mounting plate at right angles to the camera so that the projection lens of the BM-2100 is directed straight towards the short barrel of the VCR-210 and the optical axis of the barrel coincides with that of the projection lens. If necessary, loosen the Angle Adjustment Screw of the VCR-210 and turn the Mirror Box for precise positioning.

Note: The Framing Adjustment Ring (for cameras equipped with a $^2/_3$ inch pickup tube) is mounted at the factory. When the unit is to be used with a camera equipped with a 1 inch pickup tube, remove the ring.

❹ Open the casing of a slide projector, and remove the condenser lens. Attach the opal glass diffuser supplied with the VCR-210 instead. (If the diffuser does not fit, trim it to the appropriate size.) Remove the projection lens of the slide projector.

❺ Place the slide projector so that it faces the camera and the optical axis of the opal glass diffuser coincides with that of the camera.

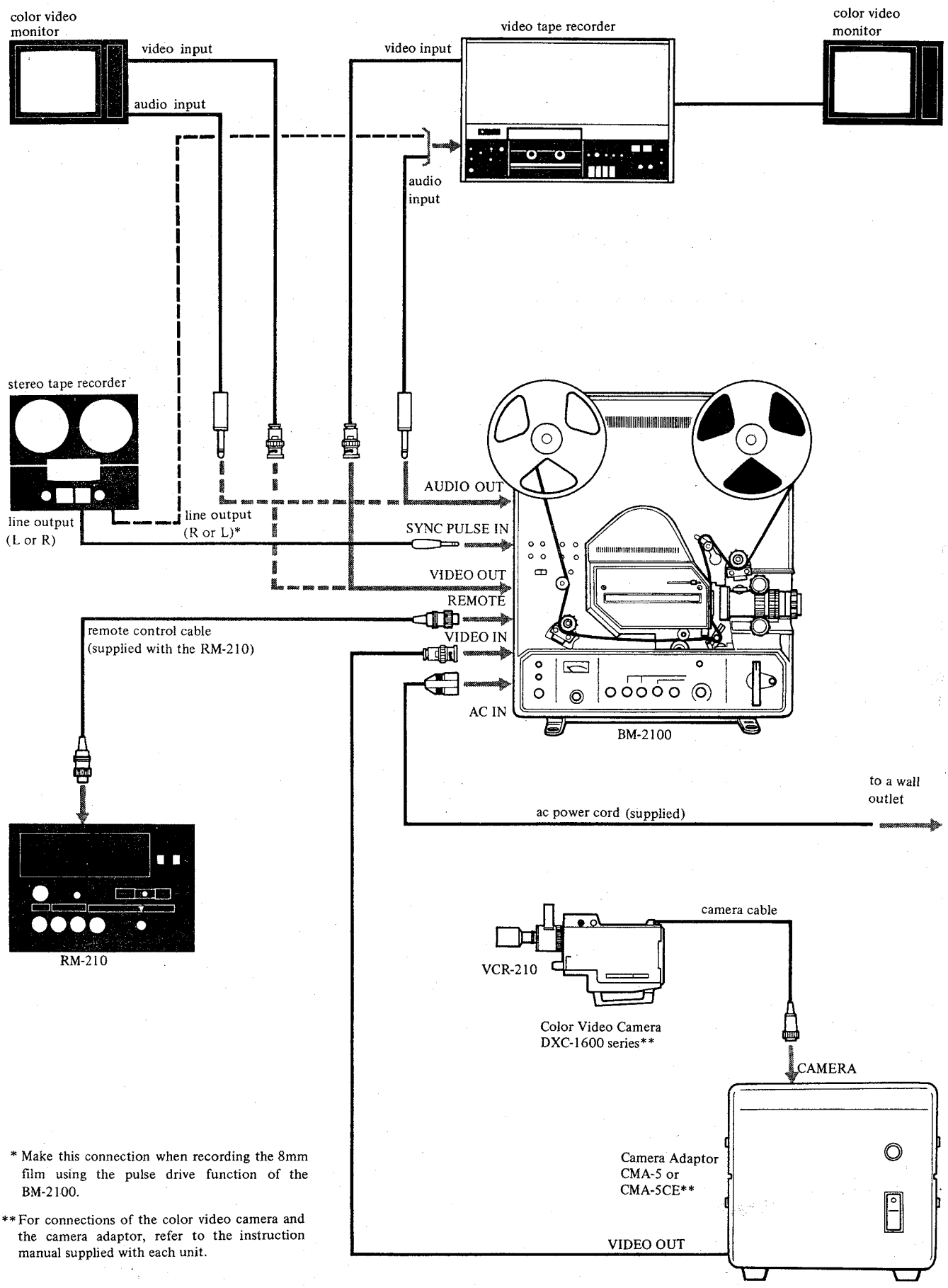


* If other type of video camera is used and the light source of the unit is insufficient for the camera, replace the opal glass diffuser between the projection lamp and the film gate in the lamp housing with the frosted glass diffuser (supplied).

For removal of the lamp housing cover and the opal glass diffuser, refer to "Adjustment of the projection lamp and parabolic mirror" and "Cleaning the diffuser".

Caution: When the frosted glass diffuser (supplied) is used, be careful not to leave the unit for more than about 30 seconds with the STILL button depressed. If this is done, the film may be damaged by the heat of the projection lamp.

CONNECTIONS



* Make this connection when recording the 8mm film using the pulse drive function of the BM-2100.

** For connections of the color video camera and the camera adaptor, refer to the instruction manual supplied with each unit.

FILM THREADING

FILM FORMAT SELECTION

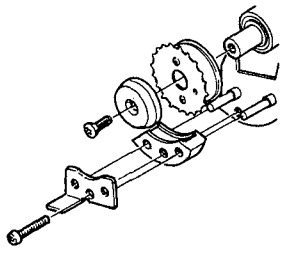
Super 8 and single 8

The unit has sprocket wheels and film locking shoes for super-8 and single-8 films mounted at the factory. Make sure that the Film Gate Format Change Lever and the FILM TYPE selector are set to "S".

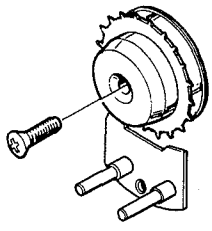
Regular 8

Replace the sprocket wheels and film locking shoes with those for regular-8 films (supplied) as follows. For easier replacement, push down the film locking shoes.

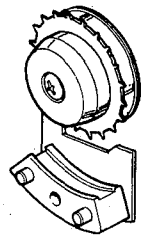
❶ Remove the sprocket wheels and film locking shoes for super-8 and single-8 films with a Phillips head screwdriver as illustrated.



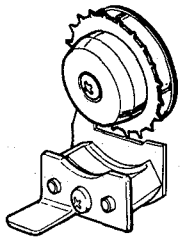
❷ Attach the supplied sprocket wheels for regular 8 and tighten the screws.



❸ Fit the film locking shoe for regular 8 (black) into the two pins as illustrated.



❹ Replace the metal cover on the film locking shoe and tighten the center screw.



❺ Set the Film Gate Format Change Lever and FILM TYPE selector to "R".

FILM THREADING

Use the same kind of reels (size and hub diameter) for both supply and take-up.

Notes

- Be sure that the reels used fit on the spindles of the unit. If the reel holding regular-8 film does not fit the spindle, transfer the film onto a reel for super or single 8 using an appropriate 8mm projector.
- Do not use reels with too small a hub diameter. Film take-up torque applied to the reels in pause operation will be very large.

❶ Place the empty reel on the left (take-up) spindle and the full reel on the right (supply) spindle.

❷ Secure the reels by pulling out and turning the reel locks.

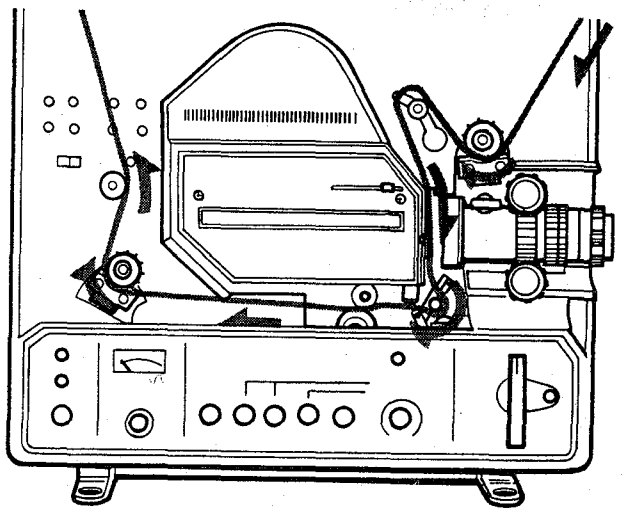
❸ Draw out approximately 90 cm (35½ inches) of leader strip (and film). Push down the film locking shoe to unlock, pass the leader strip under the feed sprocket, and lock by pushing up the shoe. Make sure that the protruding pins of the sprocket fit into the perforations of the film.

❹ Set the Film Gate Locking Lever to the right to unlock, and thread the film as illustrated. Adjust the film loop over the Tension Roller at the left of the feed sprocket so that the film is about 5–10 mm away from the Tension Roller, and lock the film at the film gate by returning the Film Gate Locking Lever to the left.

❺ Pass the film under the take-up sprocket and lock it with the film locking shoe as done at the feed sprocket.

❻ Wrap the film around the hub of the left reel, or insert the end of the film into the reel slot.

❼ Rotate the left reel a few times by hand until the slack in the film is taken up.



PREPARATIONS

Turn on the video monitor, camera, and other connected equipment, and complete all the necessary adjustments on them. For details, refer to the instruction manual furnished with each unit. (The white balance of the camera should be adjusted later. See "OPERATION".)

OPERATION

❶ Turn on the POWER switch. The Pilot Lamp will light up.

❷ Select the type of scanning system (video field) with the VIDEO FIELD selector located on the rear of the unit.

50: for a 50-field system

60: for a 60-field system

❸ Select the type of film drive control with the FILM DRIVE CONTROL selector on the rear.

SYNC PULSE IN (upper position): for controlling the film drive by the sync pulse signals supplied from a tape recorder. See page 10.

LOCAL (center position): for controlling the film drive with this unit.

REMOTE (lower position): for controlling the film drive with the RM-210 Remote Control Unit. Refer to the RM-210 instruction manual.

❹ Select the projection speed with the Projection Speed Selector Buttons, normally 18 or 24. The FINE ADJ/SPEED control is normally set to "0" (center position).

❺ Set the Function Lever to FWD. The film will start running.

❻ Depress the STILL button at a desired picture, and adjust the white balance on the camera. After completion of the white-balance adjustment, depress the 18 or 24 button again.

❼ Adjust the framing and focusing while observing the monitor screen.

Vertical framing is adjusted with the Framing Control.

Horizontal framing and the size of picture on the monitor screen can be adjusted by moving the unit sideways, forward, or backwards with respect to the camera (the short barrel of the VCR-210 attached to the camera), for proper centering.

If the picture is tilted, loosen the Angle Adjustment Screw of the VCR-210 and turn the Mirror Box for precise positioning.

Unlock the Focus Lock Knob by turning it 180° counterclockwise, adjust the Focus Control for a sharp image on the monitor, and lock the Focus Lock Knob.

Note: If the type of film is changed from super or single 8 to regular 8, or vice versa, be sure to readjust the framing and focusing.

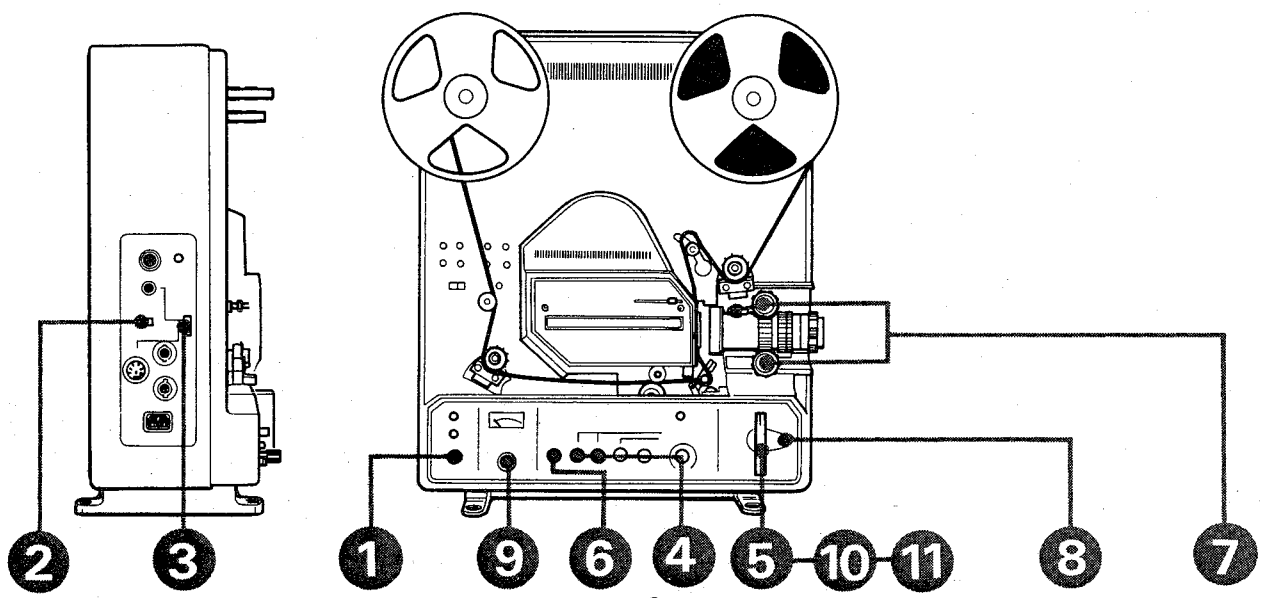
❽ When projecting a magnetic sound film, push down the Sound Pad Stopper Release Lever. The sound will be heard clearly from the monitor speaker.

❾ Adjust the playback volume with the VOLUME control.

❿ When projection of the film is finished, set the Function Lever to STOP. The Sound Pad Stopper Release Lever will automatically return to the original position.

⓫ To rewind the film, remove it from the normal film path so that it passes directly from the take-up reel to the supply reel. Set the Function Lever to REW. After completion of the rewinding, return the Function Lever to STOP.

Rewinding can also be done with the film threaded. However, such rewinding is not recommended because it may damage the film and its perforations.



Adjustment of projection speed

Normally a super-8 or single-8 film is projected at a speed of 18 or 24 frames/sec. according to the operating speed of camera during filming. Fine adjustment of the speed (–4 to +1 frames/sec. for super or single 8) is possible with the FINE ADJ/SPEED control.

A regular-8 film is projected normally at a speed of 16 frames/sec. according to the operating speed of camera. When the 18 button is depressed, turn the FINE ADJ/SPEED control from "0" to the left by approximately 90°. However, precise speed adjustment in the projection of regular-8 films requires the RM-210 Remote Control Unit. Refer to the RM-210 instruction manual.

When slow-motion or fast-speed projection is desired, depress the VARIABLE speed control selector button and turn the FINE ADJ/SPEED control to the right (fast speed) or left (slow motion).

If the VARIABLE speed control selector button is depressed with the FINE ADJ/SPEED control set to the extreme left, still picture projection will result.

To stop the film momentarily, keep the PAUSE button depressed. The film will stop while the button is being depressed. When the button is released, the film will start running again. When a still picture projection is desired, depress the STILL button. To release the button, depress the 18 or 24 button again.

For precise projection speed adjustment, the use of the RM-210 Remote Control Unit is recommended, which features stable speeds of 18 and 24 frames/sec. locked to the power line frequency or TV field, continuously variable speeds of 6 to 48 frames/sec. (for super or single 8 and regular 8), still picture, frame stop (pause), and single frame advance.

Adjustment of claw and loop sensor

The unit is adjusted at the factory, but if the picture on the monitor screen rolls because of faulty film pull-down by the claw, proceed as follows:

(a) **When the film loop is properly formed over the Tension Roller** (⓫ on page 3), check the threading of the film, since faulty pull-down by the claw may be caused by a film being improperly threaded at the film gate. If the picture continues to roll even with the film properly threaded, adjust the LOOP SEN control with a small screwdriver.

(b) **When the film is stretched too tight over the Tension Roller,** rethread the film properly, forming a proper film loop over the Tension Roller. Also check that the protruding pins of the sprocket fit into the perforations of the film.

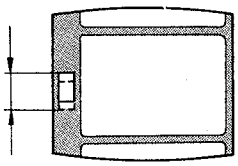
To check that film pull-down by the claw is operating properly after the above adjustments, set the Function Lever to FWD with no film in the machine and push the Tension Roller down to deactivate the safety switch which normally activates when the film is stretched too tight over the Tension Roller. If film pull-down operates properly when this is done, the noise that the pull-down mechanism makes will decrease.

If the picture is unstable, adjust the CLAW ADJ controls and/or the LOOP SEN control with a small screwdriver. The DURATION and POWER controls are provided for 50-field and 60-field TV systems and for super-8 and single-8 films (S) and regular-8 films (R), respectively. Be sure to adjust the proper controls.

The DURATION controls adjust the duration during which the claw protrudes to pull down a film frame.

The POWER controls adjust the amount of protrusion of the claw.

Adjust these controls as follows:



❶ While the film is running, move the unit towards the camera so that a perforation is displayed on the monitor. Insert a small screwdriver into the proper DURATION control, and slowly turn the control screw clockwise or counterclockwise to the point where the perforation appears as high up on the monitor screen as it will go where the picture is most stable.

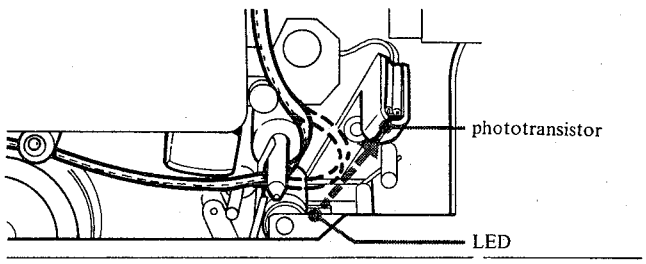
❷ Turn the POWER control counterclockwise to a point where the projection noise is least noisy and the picture is most stable.

❸ Turn the DURATION control again for a much more stable picture.

❹ Depress the VARIABLE speed control selector button and adjust the projection speed at 40 to 48 frames/sec. with the FINE ADJ/SPEED control. Turn the POWER control again for a much more stable picture. Turning the POWER control a little bit farther from the optimum position is recommended to meet a wide range of film conditions (such as in the projection of a spliced film).

❺ Turn the FINE ADJ/SPEED control to vary the projection speed and verify that the picture is stable at any projection speed. If the picture is not stable, repeat the above steps.

The LOOP SEN control adjusts the luminosity of the Light Emitting Diode (LED) for detecting the film loop, which is detected by the phototransistor.



Insert a small screwdriver into the control, and turn the control screw clockwise or counterclockwise while ob-

serving the film loop. If the control is turned counterclockwise, the luminosity of the LED is decreased, and the light from the LED is not detected by the phototransistor. As a result, the claw does not protrude, and the film loop is not formed. In this case, the picture displayed on the monitor screen slips (rolls). If the control is turned clockwise, the luminosity of the LED is so increased that the light from the LED penetrates the film loop and is detected by the phototransistor. Consequently, the claw keeps on protruding continually to form too much of the film loop. In this case, the film loop over the Tension Roller is reduced, but the film is protected by the safety switch of the Tension Roller.

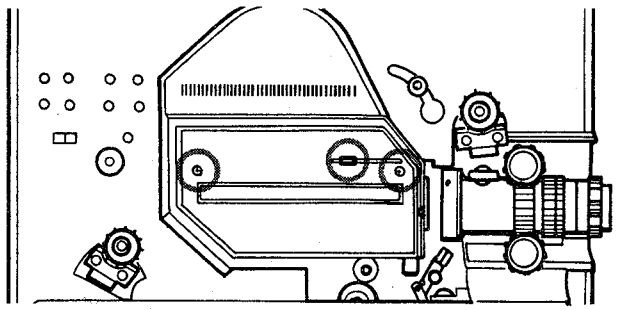
Tone adjustment

Insert a small screwdriver into the TONE control on the rear of the unit, and turn it clockwise for more treble or counterclockwise for less treble. (The position of approximately 25° from the extreme left meets the requirements of the SMPTE test film.)

Adjustment of the projection lamp and parabolic mirror

After replacement of the projection lamp, if the projected picture on the monitor screen is not illuminated uniformly, adjust the position of the projection lamp and the parabolic mirror as follows:

❶ Unscrew and remove the lamp housing cover.



❷ Thread a film with a white leader strip, and project the leader strip on the monitor screen with the STILL button depressed.

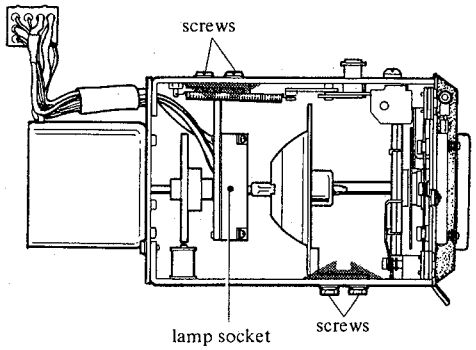
❸ Move the unit slightly to the right as you face the projection lens, to project the perforation of the leader strip, and adjust the focus.

❹ Return the unit to the original position so that the perforation goes off of the screen.

❺ Loosen slightly the four screws at the top and bottom of the lamp housing.

❻ Adjust the angle of the projection lamp and the mirror using pliers or a similar device so that the screen is illuminated uniformly.

To adjust the angle of the projection lamp, adjust the lamp socket support bracket, and to adjust the angle of the mirror, adjust the mirror support bracket.



❼ Tighten the four screws to secure the lamp and the mirror.

❽ Replace the lamp housing cover and tighten the screws of the cover.

❾ If the screen is not illuminated uniformly after the above adjustments have been made, replace the projection lamp.

CAUTION

- Always make sure that the lamp housing cover is in place when the unit is in use.
- Never subject the unit to mechanical vibration or shock while the projection lamp is lit.
- Be sure to turn the unit off when replacing the projection lamp.
- Wait until the lamp has cooled off before replacing it. Using your fingers, draw the old lamp straight out between the blades of the fan. Insert the new lamp the same way. Do not use a tool.
- After the new lamp has been inserted, clean your fingerprints off with a soft cloth slightly moistened with alcohol before turning on the unit.

Operation with a slide projector

For installation of the slide projector, refer to "INSTALLATION" on page 6.

Turn on the slide projector, and display a slide on the monitor. Adjust focus by loosening the Focus Adjustment Screw of the VCR-210 and moving the Focusing Barrel.

When the film and the slide are projected simultaneously, the slide and film images are superimposed on the monitor screen. Switching between the film and the slide is possible by turning on and off the BM-2100 or the slide projector.

When the slide projector is not in use, remove the long barrel with the Focusing Barrel by turning the knurled ring, and keep the dust cap in place.

PULSE DRIVE

Super-8 or single-8 films with an optical sound track, regular-8 films with magnetic sound track (sound/picture separation of 56 frames) or with an optical sound track, or silent films used in a synchronous sound and picture recording system intended for the amateur market, can be projected exactly in synchronism with sound by using the pulse drive function of this unit.

Pulse signal recording

Open the casing of your 8mm projector, and, with an adhesive agent, glue a PG magnet to the pulley, which is linked to the shaft of the pull-down mechanism and makes one turn per frame. Attach a PG coil by the side of the pulley. Connect the cord from the PG coil to a tape recorder. (Fig. 1) In stereo recording, the pulse signal is recorded on either the right or left channel and the sound of the film on the other channel.

If the casing of your 8mm projector cannot be opened, and if the projector is equipped with a knob which makes one turn per frame, the PG magnet and the PG coil may be attached to such a knob. (Fig. 2)

For the PG magnet and PG coil, please consult your nearest Sony dealer.

Fig. 1

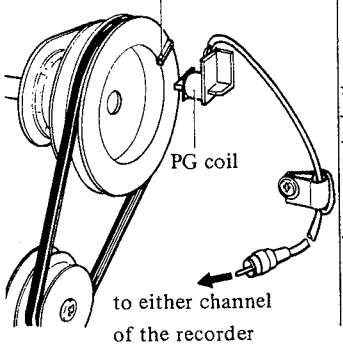
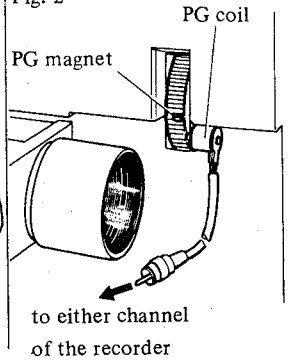


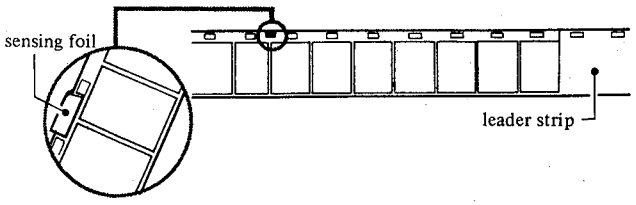
Fig. 2



Thread a film in the projector so that the very beginning of the film or the frame where projection is to be started appears in the film gate. Start the recorder in record mode, and start projecting the film. A pulse signal generates each time a new film frame appears in the film gate, and the pulse signal and the film sound are recorded in synchronism. A high-fidelity performance reel-to-reel tape recorder is recommended, but a cassette-corder with a manual recording level adjustment facility may also be used. Adjust the recording level to approximately −10 to −7 on the VU meter of the recorder for pulse signal recording.

Pulse driving

❶ Attach a piece of the Sony SF-2 Sensing Foil (optional) between the 7th and 8th perforations from the very beginning of the film or from the frame where projection is to be started.



❷ Set the FILM DRIVE CONTROL selector to SYNC PULSE IN. The PULSE DRIVE indicator will light up.

❸ Play back the tape on the tape recorder, and adjust the playback volume control of the recorder so that the PULSE DRIVE indicator flickers consistently. If the volume is increased more, the flickers of the indicator will become irregular, and an even further increase of the volume will cause the indicator to remain constantly lit. Keep the volume at a level at which the flickers are regular. After completion of the adjustment of the playback volume, stop the recorder.

❹ Thread the film, and set the Function Lever to FWD with the 18 or 24 button depressed and the FINE ADJ/SPEED control set to "0". (When the FILM DRIVE CONTROL selector is set to SYNC PULSE IN, the STILL button and the VARIABLE speed control selector button are inoperative.) The film starts running, and stops when the frame where projection is to be started (the frame marked with the sensing foil) reaches the film gate.

❺ Start the recorder in playback mode. The unit will start projecting the film. Slowly turn the FINE ADJ/SPEED control clockwise or counterclockwise while observing the FILM SPEED indicator of the RM-210 Remote Control Unit. When the projection speed falls within the range of ±0.5 frames/sec. of the speed at which the 8mm projector was operated during pulse signal recording, the FILM SPEED indicator will show a constant speed reading, meaning that the speed falls within the range of synchronization. Then, slowly turn the FINE ADJ/SPEED control to find the upper and lower limits of the constant reading of the indicator, and set the knob at the center of these limits. When projecting a regular-8 film, which is normally filmed and projected at 16 frames/sec., slowly turn the FINE ADJ/SPEED control counterclockwise for a constant reading of the FILM SPEED indicator (near 16 frames/sec.).

Note: The projection speed can also be adjusted to fall within the range of synchronization using an oscilloscope as follows: Open the casing of the unit, and connect an oscilloscope to the output from the TP5 on the printed circuit board. While observing the waveform displayed on the oscilloscope, slowly turn the FINE ADJ/SPEED control to the point where the upper and lower horizontal lines of the square wave are equal to each other.

❻ Rewind both the film and the tape, and repeat the above step ❹.

❼ Start the recorder in playback mode. When the point on the tape where the pulse signal and the sound start arrives, the unit will start projecting the film. Thus the film and the sound will start exactly in synchronism.

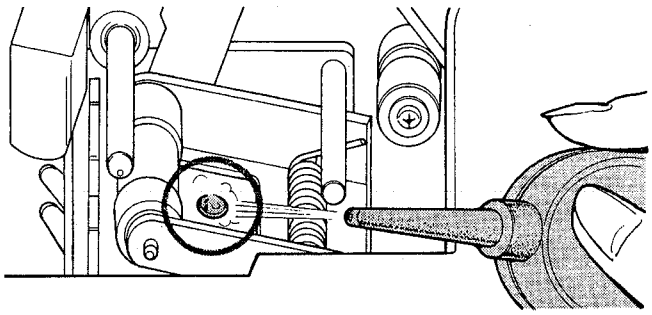
MAINTENANCE

The following maintenance is essential for the proper operation of the unit.

Cleaning the film gate and film path

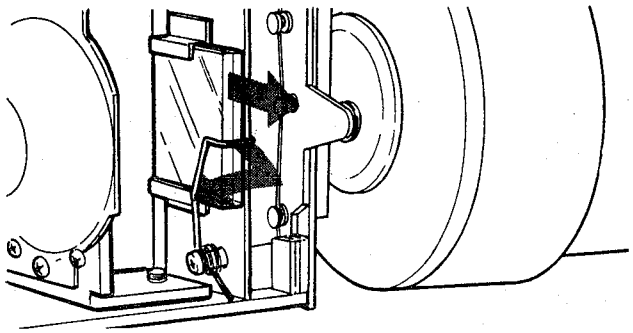
Blow off dust at the film gate with a dust blower or a fine soft brush. If dust persists, clean the film gate with a small hard brush (such as a makeup brush for eyebrows). Also clean every film path and the tension pole with a small hard brush.

Dust and dirt on the light emitting surface of the LED of the loop sensor will decrease the luminosity of the LED and cause abnormal pull-down claw movement. Blow off any dust with a dust blower.



Cleaning the diffuser

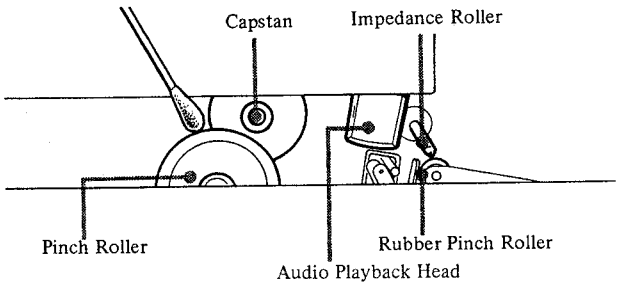
For cleaning of the diffuser, remove the lamp housing cover as described in "Adjustment of the projection lamp and parabolic mirror". Remove the diffuser by releasing the support spring, and clean it with a soft cloth.



Cleaning the head

Keeping the audio playback head clean is essential for proper operation of the unit. Accumulations of dust and sound track oxides on the head will result in sound drop-outs, a loss of high frequencies and excessive sound track wear. Accumulations of dust on the capstan and the pinch rollers will result in scratches on the film.

Moisten a cotton swab or a. soft cloth with a denatured alcohol, and gently wipe the head, capstan and pinch rollers over which the film and the sound track(s) travel.



Cleaning the cabinet

Clean the cabinet with a soft cloth slightly moistened with water or a mild detergent solution. Do not use solvents such as alcohol, benzine, or thinner as they may mar the finish of the cabinet.

1-2. CIRCUIT DESCRIPTION

– Introduction –

When a moving picture from film is picked up with a TV camera, horizontal stripes go from the top to the bottom on the TV screen, or unacceptable flickers appear on it. This means that such a simple method cannot serve for practical use.

This is because the film speed (18 frames per second) differs from the number of frames per second (30) on the TV screen.

To bypass this difficulty, conventional film camera-projectors employed a three-blade shutter system whose operating frequency is approximated to the number of frames per second (20).

However, such a scheme cannot handle 18- and 24-frames per second and variable-speed moving pictures and stills.

This suggests the necessity of special telecine equipment which refers to a system for film transmission and conversion of image signals into TV video signals.

– BM-2100 system –

The telecine equipment (for 8-mm film) described here consists of the following units:

- Ⓐ Telecinecoder BM-2100 (transmitting optical image to the camera)
- Ⓐ Mounting plate MVS-210 (for installation of BM-2100 and the camera)
- Ⓐ Prism unit VCR-210 (reflecting the beam to the camera at a right angle)
- Ⓐ Remote control unit RM-210 (for remote control of operation and for indication of the number of frames per second)
- Ⓑ Video camera (black-and-white or color)
- Ⓑ Monitor TV (with the input terminal for 75-Ω, 1vp-p video signals)
- Ⓐ Two types of sprocket wheels, each for a film type (Super 8 or Regular 8)

The units marked with Ⓐ are available as integral parts of the BM-2100 system. VCR-210, when used, is mounted on the camera (C-mount type).

The camera is installed upside down when used in this telecine system. Therefore, Sony's DXC-1700 series color video camera is recommended considering the mounting level, etc.

– Converting optical images into electric signals –

The well-known equipment for such conversion includes a TV camera and a facsimile. The two share the converting method by which images are recognized spot by spot. Lines and other figures are composed of spots. However, they are quite different in that the pickup tube (hereafter called a vidicon) of the TV camera has a memory face comprising numbers of minute blocks located next to the focusing nesa film. This is an outstanding feature of the TV camera.

– Function of the vidicon –

How to store optical images is explained below. The basic operation of the vidicon is as follows. Here, it is assumed that no light is externally supplied to the vidicon. The next figure shows the essential parts of the vidicon.

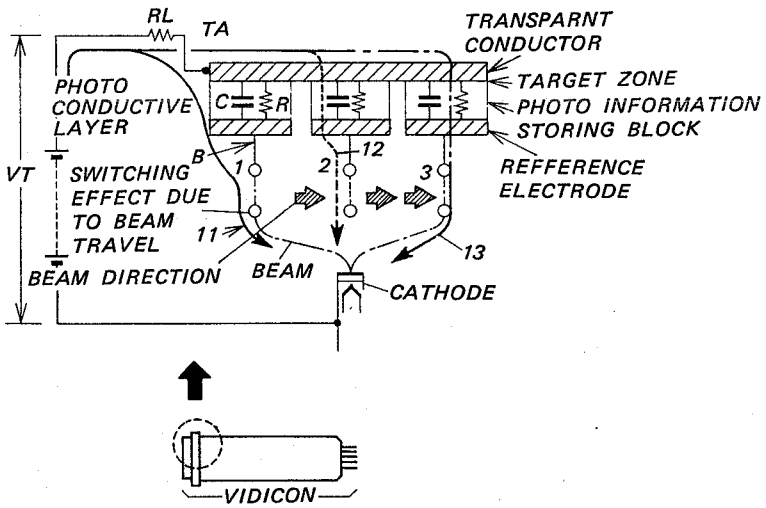


Fig. 1

As shown in the Fig. 1, there is a photoconductive electrode consisting of minute blocks aggregated on a plane. Each block between one side (called the beam side) and the other (called the target zone side) contains a resistor and a capacitor parallel interconnected.

When a beam scans blocks 1, 2, and 3 in the arrow direction, the capacitors in the blocks are charged by currents I_1, I_2, and I_3 via load RL. If each block has the same CR couple, the values of the currents are also the same. Assuming that the resistance in each block is infinite, the capacitor is fully charged after a certain time. The currents then disappear, that is, the potential at the target electrode is stabilized at the value of VT, producing no change. (The voltage across each block is equal to VT.)

Next, let us consider the case that a film image from the outside is momentarily focused on the target zone and then darkens. At the instant of the focusing, the resistor in each block drops in resistance because of the incident light. This causes the capacitor to be discharged to an extent depending on the intensity of the incident light. This means that the potential at each reactance electrode indicates the level of the light incident to the corresponding block.
When a beam scans reference electrodes 1, 2, and 3, the voltages across the blocks change the potential at the target electrode with respect to the potential at the reference electrodes, thus producing an electric signal indicating the optical image.
Recapitulating the above, the vidicon has the following functions:

1. A frame as a whole is recognized as a pattern and held.
2. The held information remains unchanged (although during a short period) until the frame changes.
3. Focusing and signaling may occur at the same time or at different times.
4. No-information (dark) periods may be present.

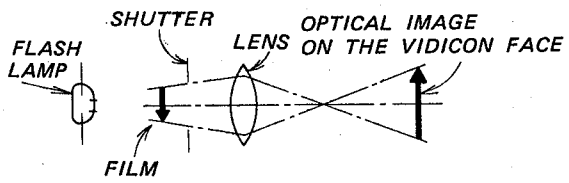


Fig. 2

Suppose that, in the aboce figure, the vidicon emits no beam and no current flows through the vertical and horizontal deflection yokes. Next, turn on the flash lamp momentarily, and then start the emission of beams and the operation of the deflection yokes. The above sequence is illustrated in the next timing chart.

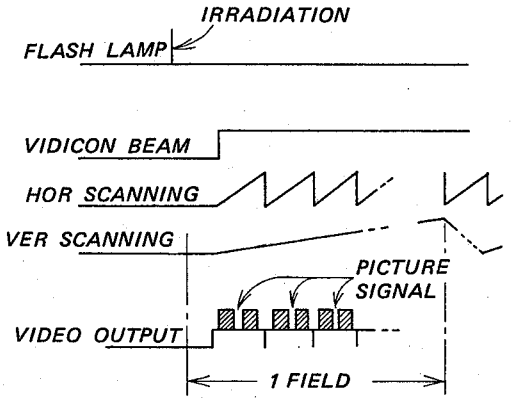


Fig. 3

— Time during which to irradiate an optical image —

The explanation in this item is most essential in understanding the BM-2100 telecine system.
The description thus far has dealt with a light source (flash lamp) emitting momentary light. Now, let us consider the light source as emitting light during a certain period of time.
The following properties of the vidicon have, bearing on the above assumption.

- The intensity of the incident light is in a proportional, not to say completely linear, relation with the output.
- The constant of proportion is independent of the time during which the incident light is present.

If it is possible to neglect the characteristic regarding to what extent data held in the storage of the vidicon is lost before it is read, the following property must be added.

- An image may be at any position on a field if it is focused during a specific time interval.

That is to say, the data about an image once focused remains unchanged during the interval from the time scanning starts to the time scanning has covered the field. This temporary nonvolatality can apply also to the operation during image focusing. Therefore, even if focusing (input from the light source) and reading occur simultaneously, the operation is carried out under the same condition as in the case where a focused image is read afterward.

With all the above-mentioned functions, BM-2100 transmits images on film to the camera (details will be described later).

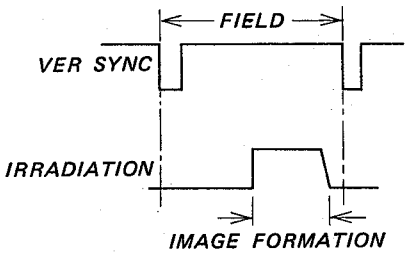


Fig. 4

– Number of irradiations and synchronizing the shutter –

At each field, one irradiation is carried out. If no irradiation is performed at a field, theoretically the dark, but actually a residual image after the preceding one, is read and transmitted to the monitor TV.

Therefore, the rotary shutter (a 1-blade shutter) in BM-2100, which governs the irradiation on the film face, rotates at the following speed.

60 revolutions per second = 3600 rpm for 60 fields per second

50 revolutions per second = 3000 rpm for 50 fields per second

By synchronizing the shutter with the TV vertical sync signal, it is possible to transmit quite a stable picture carried on a TV video signal as far as a still is concerned.

– Pull-down –

The film must be advanced to the next frame except for a still. While the film is irradiated, the film is stationary. The film is advanced to the next frame during the interval when the shutter is closed and waiting for the next irradiation. This action is done by a claw which engages with the perforation on the film and advances the film. The claw receives a drive tapped from the shutter rotating shaft, so that it is synchronized with the shutter. Assuming that the number of frames per second is 60, the operation proceeds as shown in the next timing chart.

Since the claw reciprocates once in a turn of the shutter, the actual pull-down period is equal to or less than the time during which the shutter turns 180°; that is, within 16.66ms/2 = 8.33ms (for 60 fields per second).

– EXAMPLE OF A FRAME ADVANCE PER FIELD –

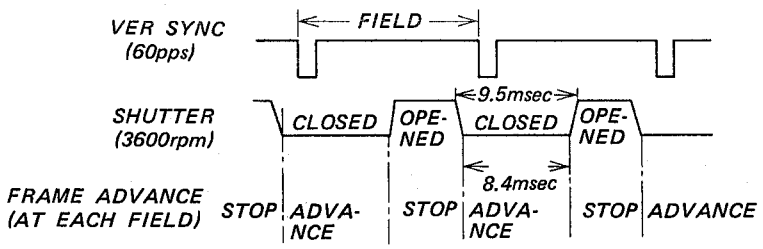


Fig. 5

– PULL-DOWN CLAW –

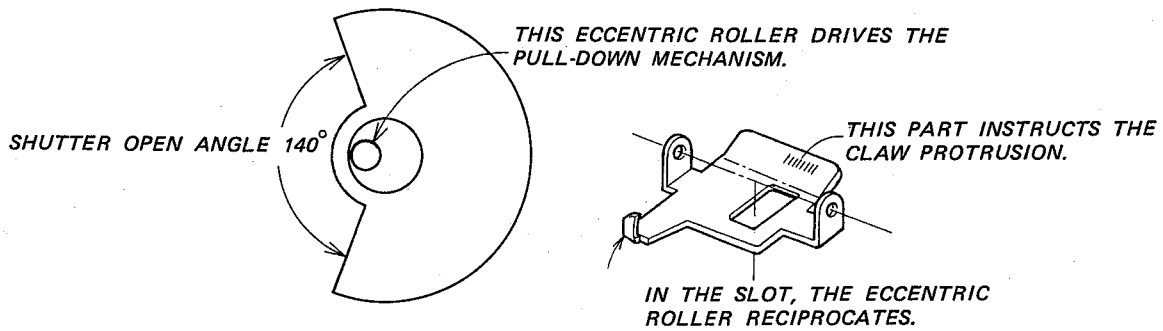

THIS ECCENTRIC ROLLER DRIVES THE PULL-DOWN MECHANISM.
SHUTTER OPEN ANGLE 140°
THIS PART INSTRUCTS THE CLAW PROTRUSION.
IN THE SLOT, THE ECCENTRIC ROLLER RECIPROCATES.

Fig. 6

– Handling remaining frames –

The film speed of 60 frames per second does not in fact exist. This telecine equipment can handle two fixed film speeds of 18 and 24 frames per second and variable speeds from 0 to 48 frames per second. Let us take 18 frames per second as an example for explanation (the same principle applies to other cases).

18 frames per second is equivalent to 55.55 . . . ms per frame. Also, 60 fields per second is equivalent to 16.66 . . . ms per field. Using these relations, the actual operation is represented by the following timing chart.

As shown Fig. 7, the 1st to 4th frames are projected in synchronization with TV frames, but the speed of 18 frames per second is maintained. An image on the film is allocated to each field as a slightly extendable projection time rather than an amount of light. An asterisked arrow indicates one projection of a frame (one conversion of the frame into a TV signal). The number of projections per frame changes from 4 to 3 repeatedly, thus eliminating the apparent difference between the film speed and the TV field frequency.

– FILM PULL-DOWN AND NUMBER OF IRRADIATION –

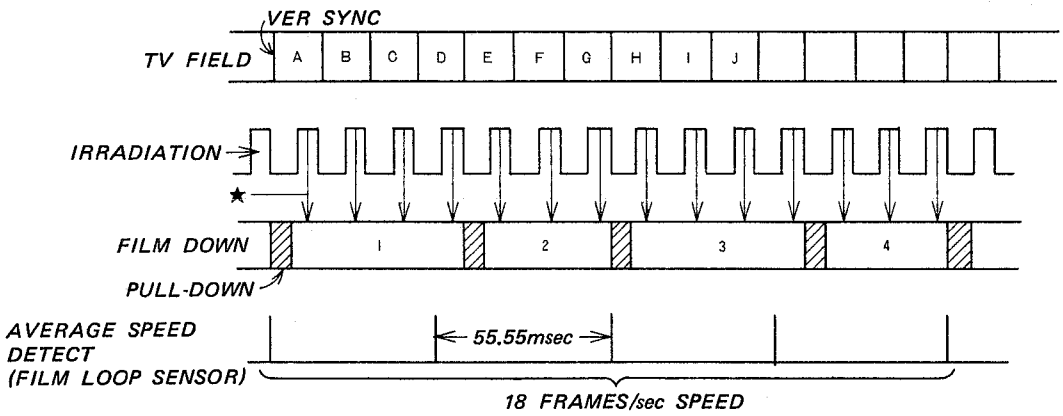


Fig. 7

— Maintaining the film speed —

The correct film speed is achieved by means of a mechanism consisting of a capstan and a pinch roller. A servo circuit for the capstan motor provides the average speed with stability. Also, the above-mentioned film loop sensor informs the system of each time to pull down the film.
The following description covers the operation of the circuitry.

— Synchronizing the shutter with TV fields —

The shutter is opened and closed in step with the TV field signal. For this purpose, the composite video signal is sent from the TV camera, and the vertical sync signal is extracted from it. This allows the shutter operation to dispense with the condition that the TV camera is picking up pictures from BM-2100. Since the sync signal is generated in the TV camera, all that is needed to achieve synchronization is to connect a cable.

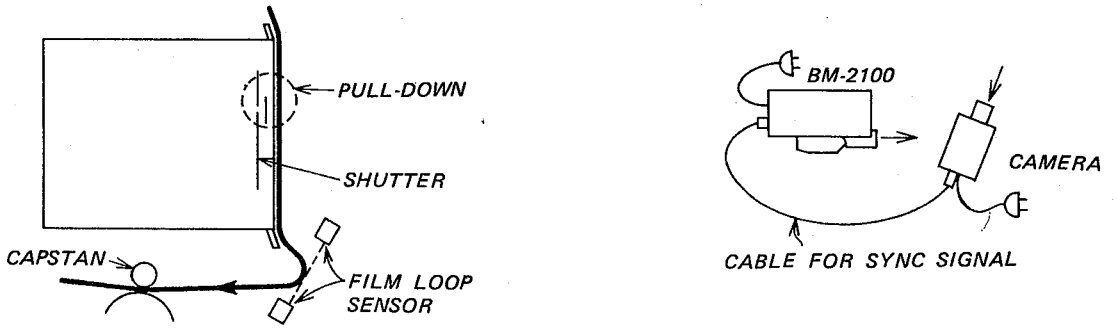


Fig. 8

— SYNC SEPARATION —

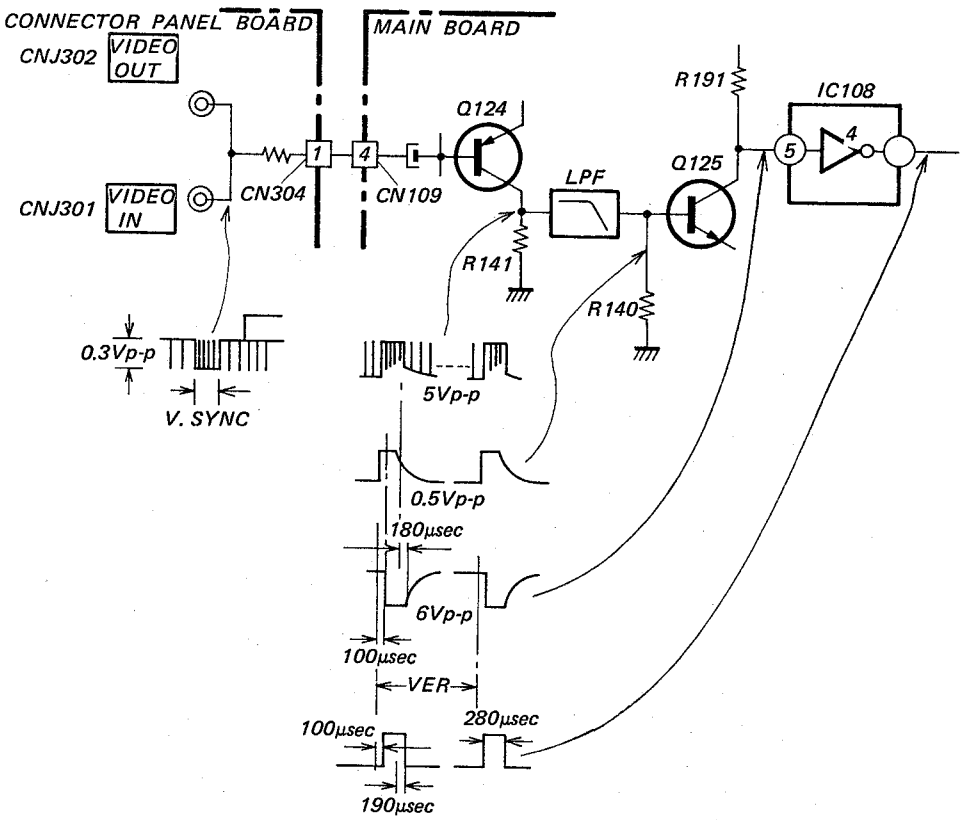


Fig. 9

The camera output fed to VIDEO IN is supplied to the sync separator (shown in the Fig. 9), where only the vertical sync signal is isolated as 280-μsec wide pulses which lag the sync interval by 100μsec.

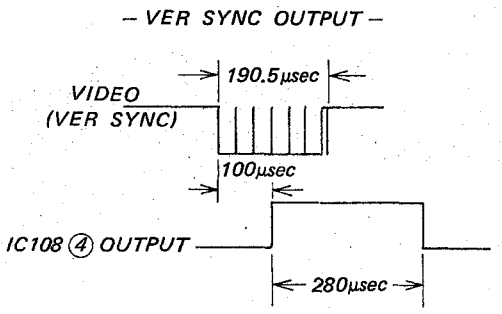


Fig. 10

The sync signal serves as a reference. The signal to govern the speed of the shutter drive motor is generated by a separate pulse generator coil, and the two signals are compared. These operations are done by Q113 and IC106 in the main printed-circuit board.

In the Fig. 11, various waveforms are shown (where the comparator output is 50%-duty cycle pulses). The comparator output is applied to the shutter motor servo circuit as a control signal. If the motor slows or quickens, the output of the pulse generator deviates from the vertical sync signal within a limit of one field.

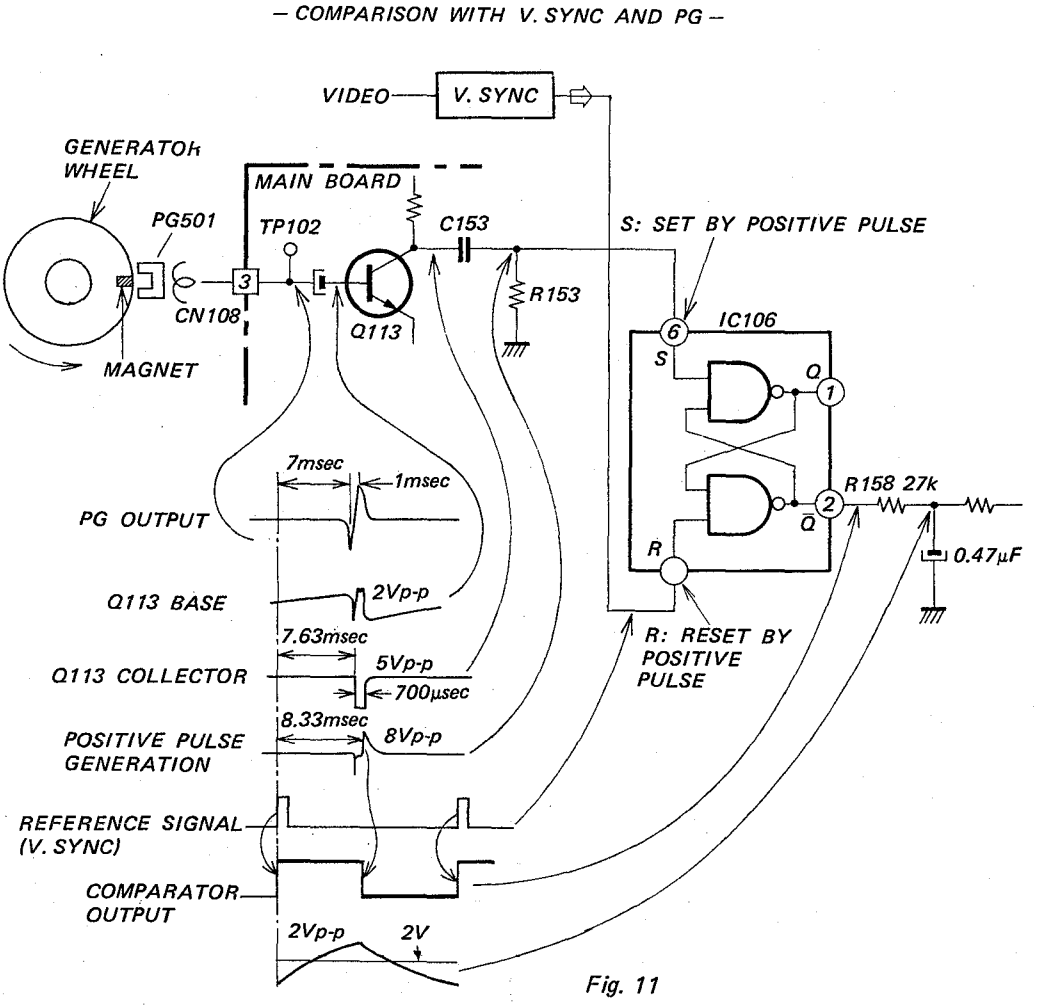


Fig. 11

– Shutter motor servo circuit –

Q107 – 110 and 117 – 119 in the main printed-circuit board and motor M502 constitute a servo. There are now two servo system, FG and PG, as shown below.

The FG servo operates as follows.

- Passes the output of the FG coil of the motor through an amplitude limiter to isolate the FM component.
- Passes the FM component through a low pass filter to generate switching pulses whose voltage is inversely proportional to the motor speed.
- Provides a motor current source for the maximum speed, and, using the above servo output, controls the current so as not to exceed a specific limit.

– SHUTTER MOTOR SERVO –

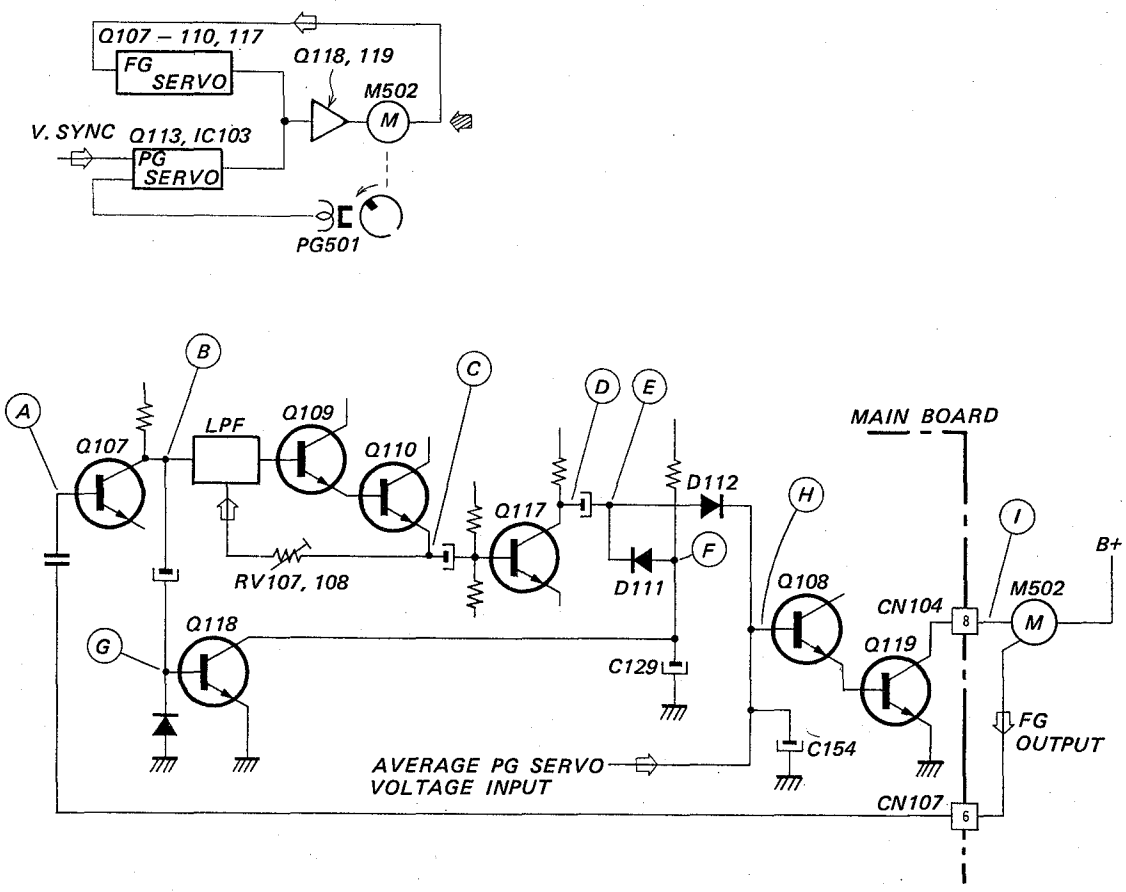


Fig. 12

– SYNCHRONIZED SERVO WAVEFORM –
(WITH VIDEO SIGNAL)

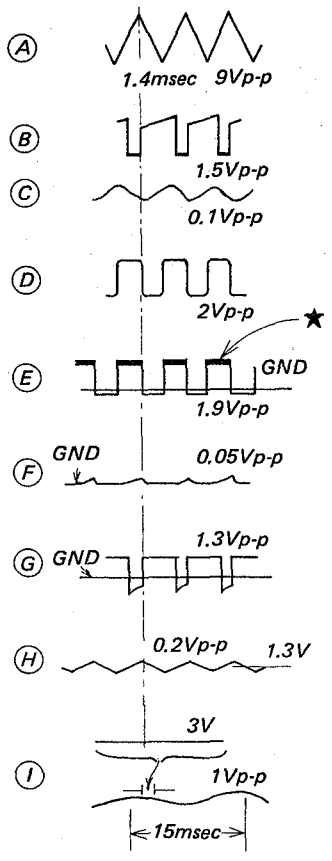


Fig. 13

When the motor is supplied with power from B+, the current to start the motor flows via D111 because Q108 is off. Once the motor is started, Q108 has no concern with motor operation. The motor speed is determined by the average input from the PG servo plus the peak value of the asterisked pulse from the FG servo.

RV107 and 108 change the characteristic curve of the LPF in the FG servo, providing a means to vary the motor speed. Use RV107 for 60 fields per second, and RV108 for 50 fields per second.

The motor speed is then 3600 rpm (60 rps) when the TV field frequency is 60 per second, and 3000 rpm (50 rps) when the TV field frequency is 50 per second.

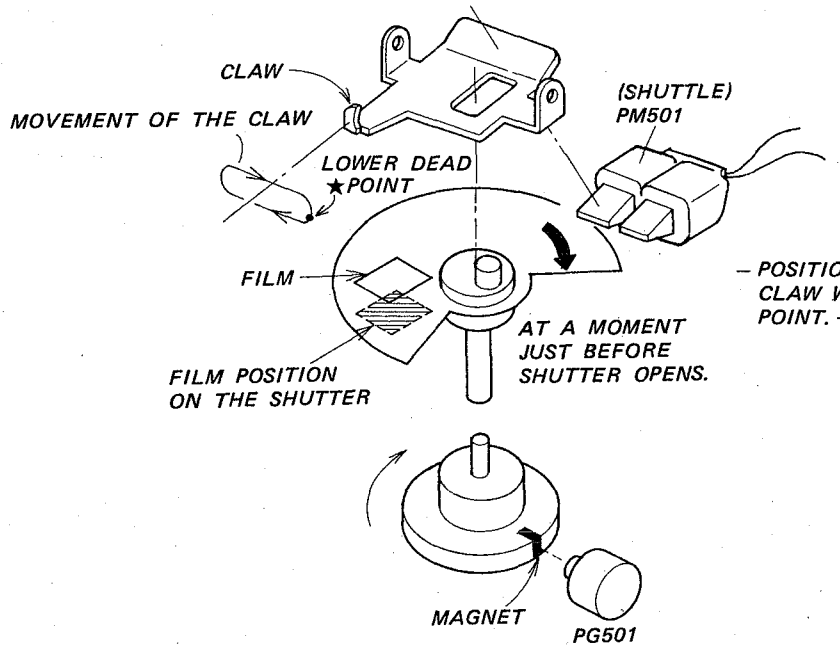
The motor turns clockwise as viewed from the lens side.

– Pull-down circuit –

The claw resides in the pull-down block and reciprocates with the aid of an eccentric roller attached to the shutter shaft. The pull-down mechanism is shown below.

The film is pulled down as follows.

- The film loop sensor detects the need for a pull-down (reduced loop), and generates a pull-down enable signal.
- A pull-down commences with the PG pulse which has arrived immediately after the pull-down enable signal.



– POSITIONS OF PG, MAGNET, SHUTTER AND CLAW WHEN CLAW COMES TO LOWER DEAD POINT. –

Fig. 14

– PULL-DONW CIRCUIT –

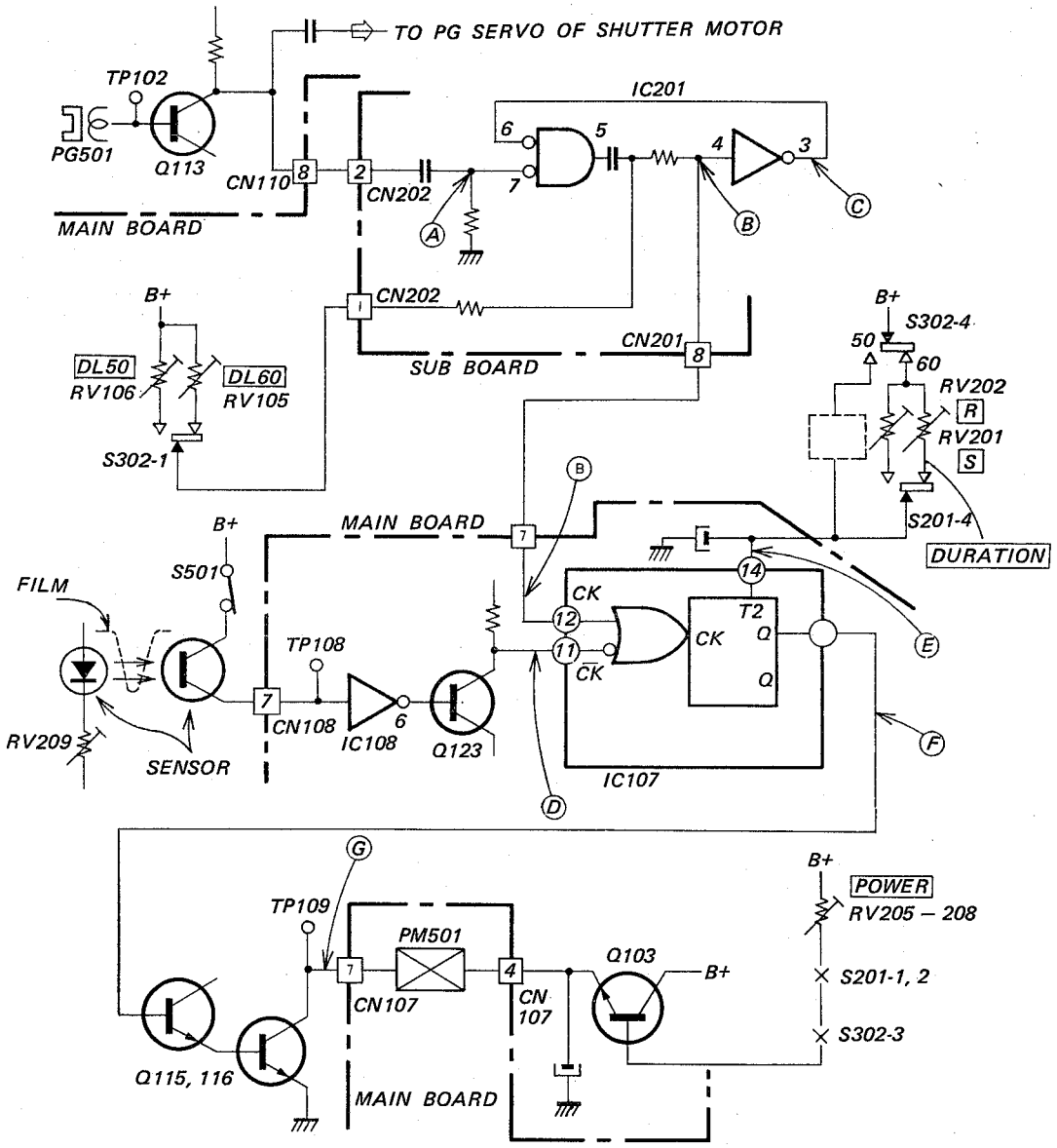


Fig. 15

[Film Loop Sensor]

The film loop sensor operates as follows.
As long as sufficient film loop is present, the sensor is inactive, and Q123 generates a positive voltage. Therefore, no signal is supplied to pull-down circuit IC107. Also, S501 connected in series with the sensor functions as follows.

- If the upper film loop is eliminated, pull-down will break the film perforation.
  In this case, S501 stops pull-down.

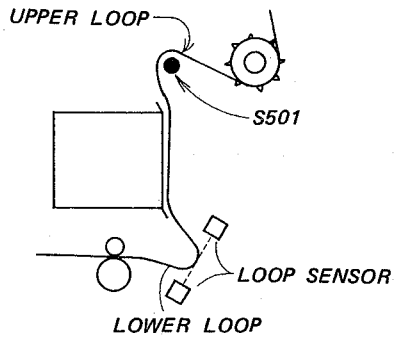


Fig. 16

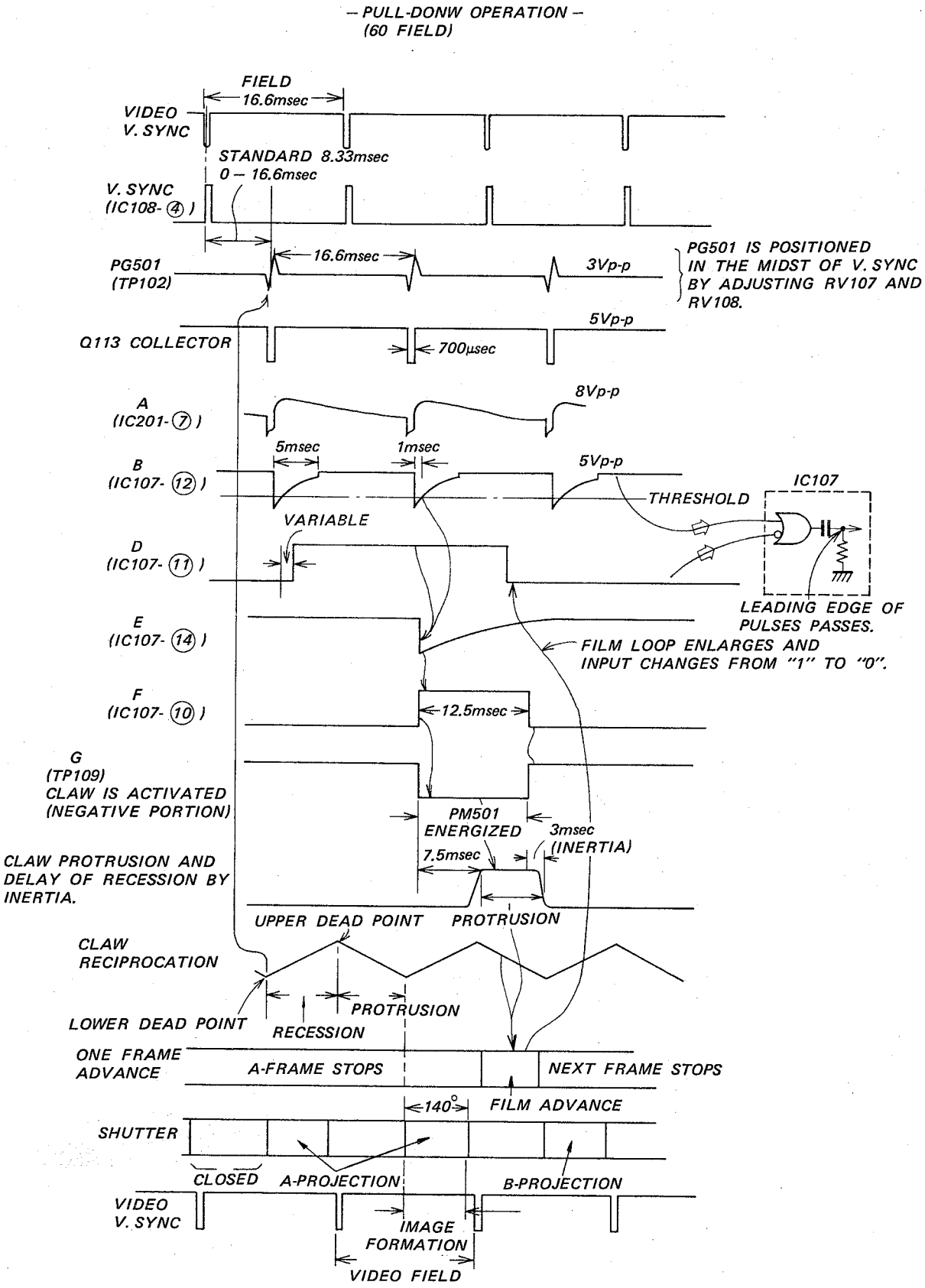

– PULL-DONW OPERATION –
(60 FIELD)
FIELD
16.6msec
VIDEO
V. SYNC
STANDARD 8.33msec
0 – 16.6msec
V. SYNC
(IC108-④)
16.6msec
PG501
(TP102)
3Vp-p
PG501 IS POSITIONED IN THE MIDST OF V. SYNC BY ADJUSTING RV107 AND RV108.
5Vp-p
Q113 COLLECTOR
700μsec
8Vp-p
A
(IC201-⑦)
5msec
1msec
B
(IC107-⑫)
5Vp-p
IC107
THRESHOLD
VARIABLE
D
(IC107-⑪)
LEADING EDGE OF PULSES PASSES.
E
(IC107-⑭)
FILM LOOP ENLARGES AND INPUT CHANGES FROM "1" TO "0".
F
(IC107-⑩)
12.5msec
G
(TP109)
CLAW IS ACTIVATED
(NEGATIVE PORTION)
PM501 ENERGIZED
7.5msec
3msec (INERTIA)
CLAW PROTRUSION AND DELAY OF RECESSION BY INERTIA.
UPPER DEAD POINT
PROTRUSION
CLAW RECIPROCATION
LOWER DEAD POINT
RECESSION
PROTRUSION
ONE FRAME ADVANCE
A-FRAME STOPS
NEXT FRAME STOPS
140°
FILM ADVANCE
SHUTTER
CLOSED
A-PROJECTION
B-PROJECTION
VIDEO
V. SYNC
IMAGE FORMATION
VIDEO FIELD

Fig. 17

– Pull-down operation –

The pull-down operation is briefly described below (see the Fig. 17).

- The film is pulled down by only one frame in each operation, the time for each being less than the interval of one field.
- The solenoid for pull-down is active during the following period:
  Within 8.33ms for 60 fields per second
  Within 10.0ms for 50 fields per second
  The solenoid starts attraction 7.5ms after power is supplied, and it is disenergized 3ms after power is turned off.
  If the field frequency of 60 per second is employed, the solenoid is supplied with a voltage for 12.5ms.
- IC107 is a monostable multivibrator whose active time is variable. It is fed with the output of an OR gate which has two inputs 11 and 12: the former is used as a timing gate, and the latter is used for timing as shown.
- When the film is pulled down, the loop sensor is closed with the film and starts to wait for the next loop reduction.
- If proper adjustment has been made, the film is pulled down in the later half of a video field. However, depending on other factors, including adjustments on the FG and PG servo systems for the shutter, the position of pull-down moves over the entire video field. This is because the shutter (claw) and the PG servo are fixed mechanically.

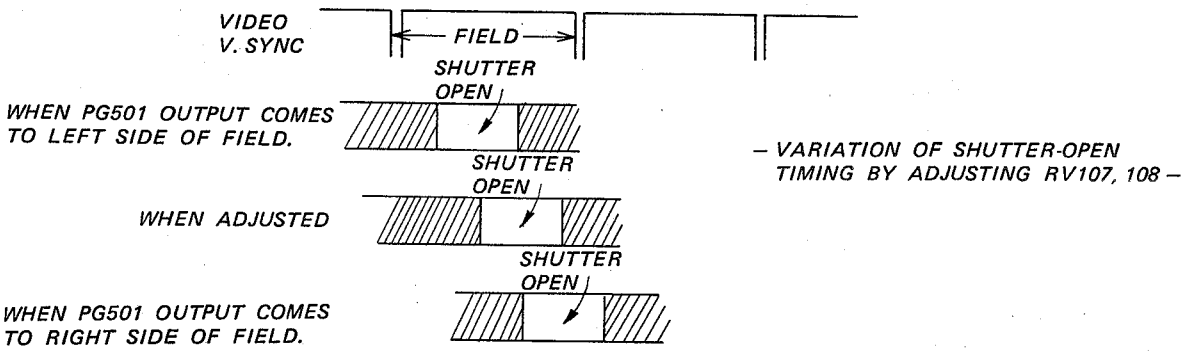


Fig. 18

– Adjustment for pull-down –

The pull-down circuit has three points to be adjusted. These adjustments influence the operation of pull-down solenoid PM501 as follows.

– CLAW MOVEMENT AND ITS ADJUSTMENT –

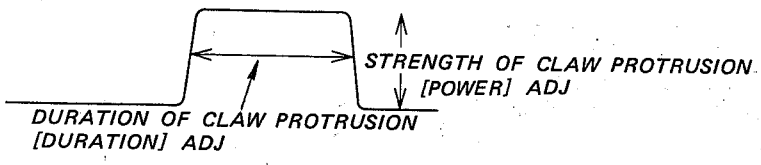


Fig. 19

– Capstan motor servo –

It is necessary for the film to run at a constant speed in the wide range up to 48 frames per second. For this purpose, the capstan motor servo has a wide operation range. It is composed of IC103 and Q104 – 106 in the main printed-circuit board and of motor M501.

– Pulse drive circuit –

This circuit ensures that feeding a pulse to the side connector panel causes the film to advance by one frame. It is supplied with a control signal generated in external sensor IC502 and IC108 and IC106 in the main printed-circuit board. The circuit is constructed in combination with the above-mentioned servo circuit.

– PULSE DRIVE CIRCUIT –

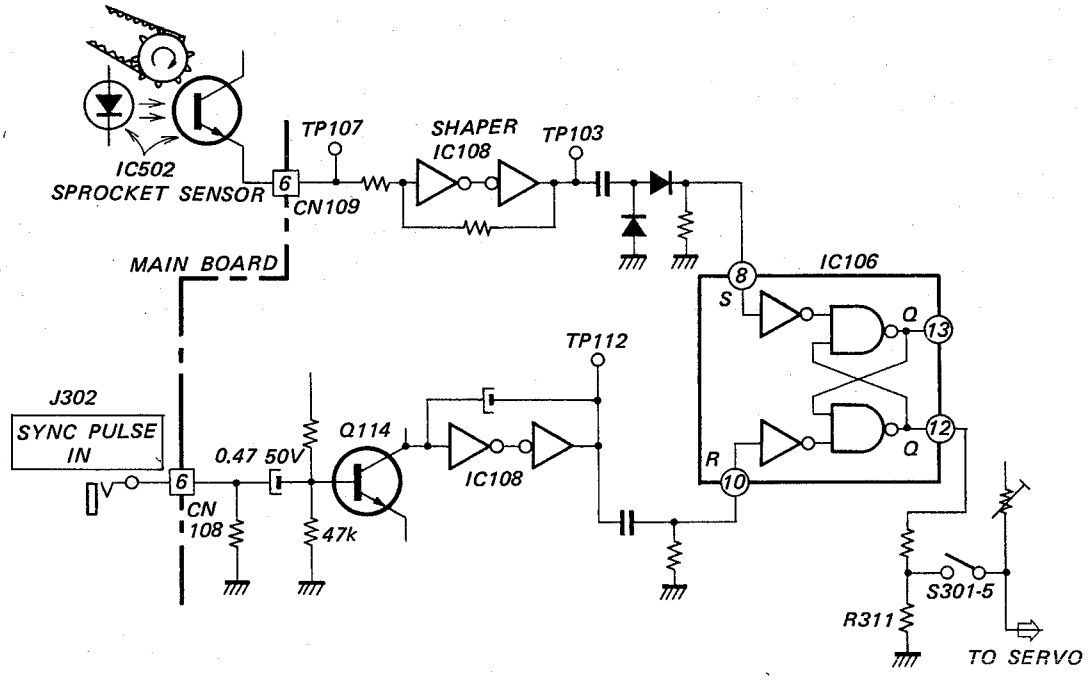


Fig. 20

Its operation is as follows.

- S301-5, when closed, connects R311 to the servo circuit to stop the capstan motor.
- When fed with the sync pulse, IC106 is reset to start the motor.
- When a pulse corresponding to one frame comes from the sprocket sensor, IC106 is set to stop the motor.

– Pause circuit –

The film is stationary as long as the pause button is kept pressed. This circuit consists of IC201 and Q203 – 208 in the auxiliary printed-circuit board and of pause solenoid PM502.

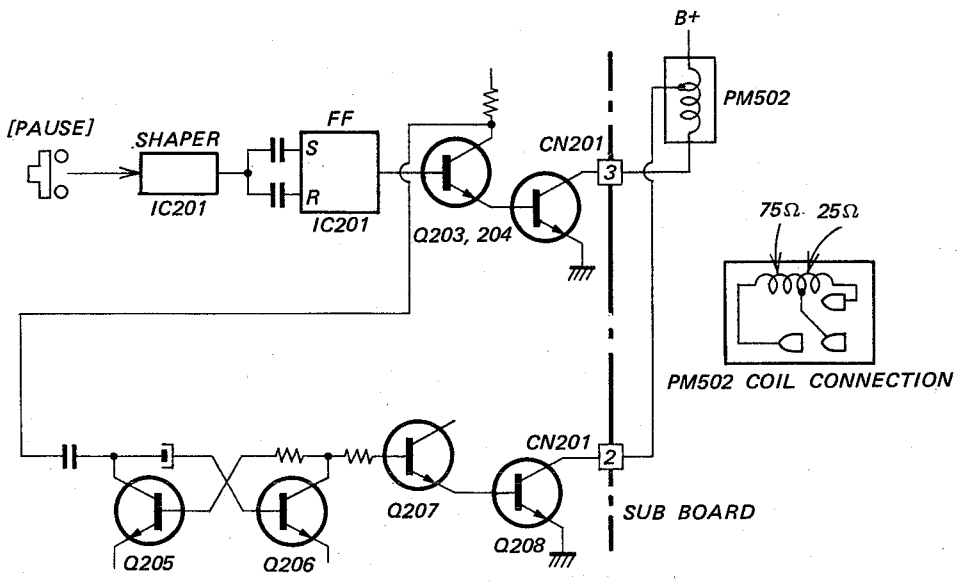


Fig. 21

Pressing the pause button inverts the monostable multivibrator consisting of Q205 and 206 (turns off Q206), thus activating PM502 with a large current. Just after the activation, Q203 and 204 pass a holding current. Flip-flop IC201 is inverted at each pulse input, thus storing the state of pause/release.

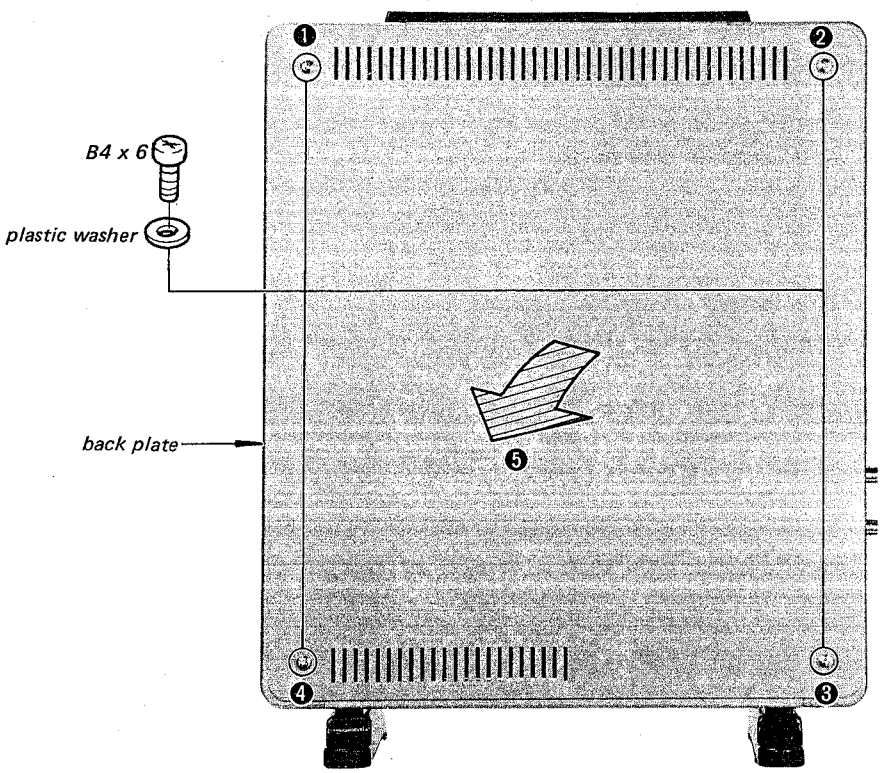
– Projection lamp –

An incandescent lamp cabled JC 12V 50W is used. Therefore, it does not flicker. It lights with 12V AC power. This type is the most common for 8-mm projector.

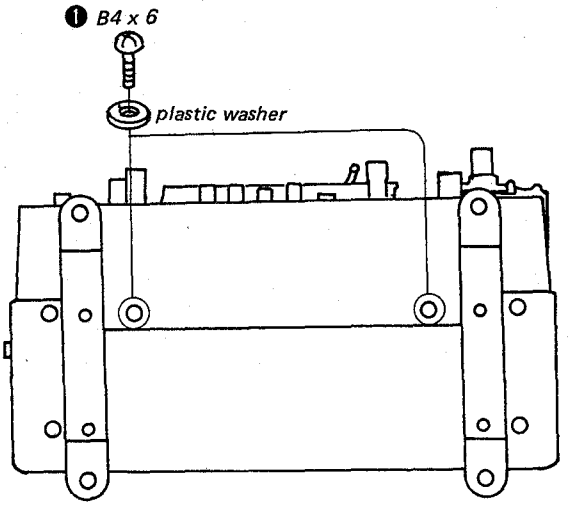
SECTION 2
DISASSEMBLY

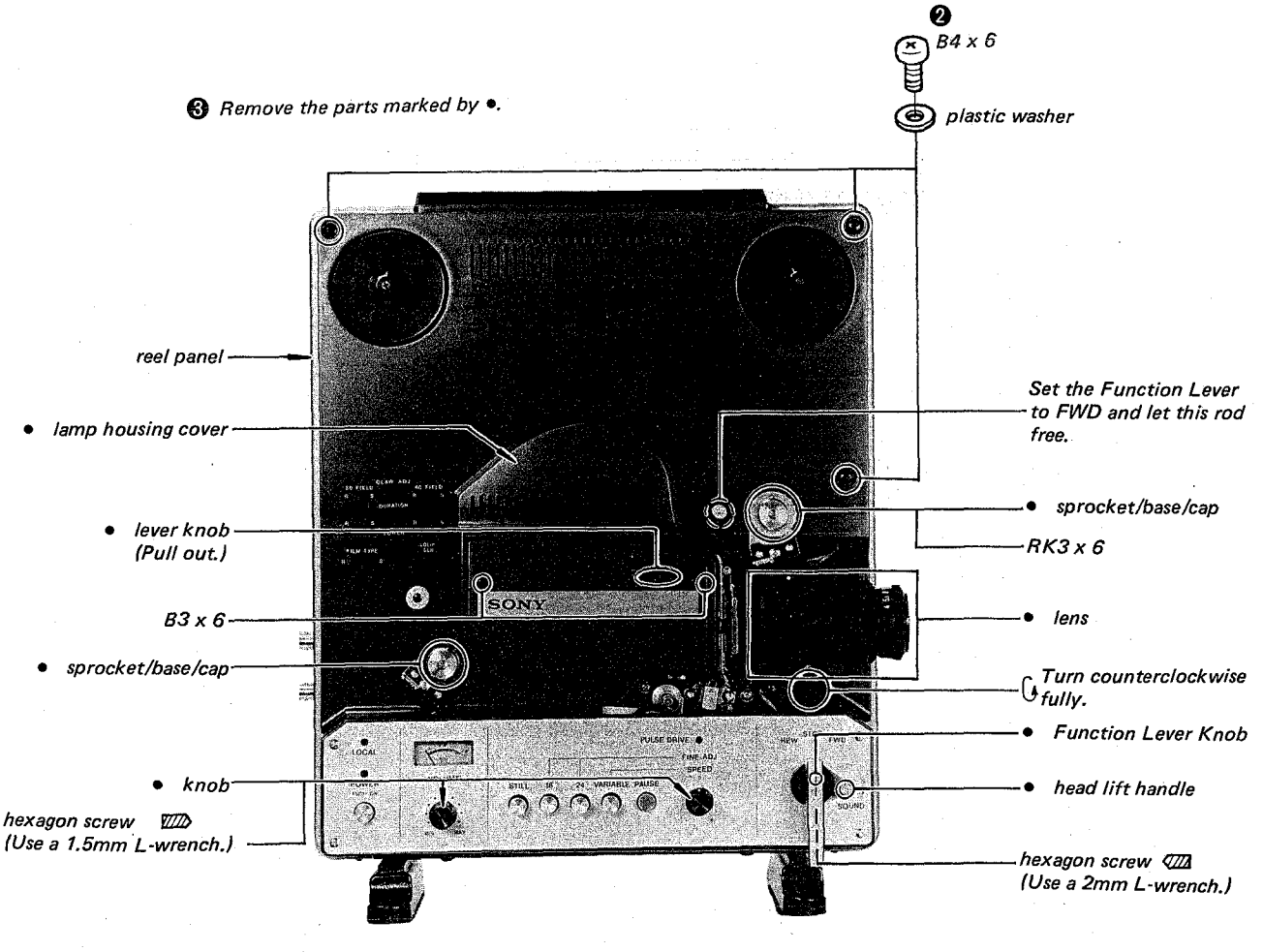
BACK PANEL REMOVAL

- Follow the disassembly procedure in the numerical order given.

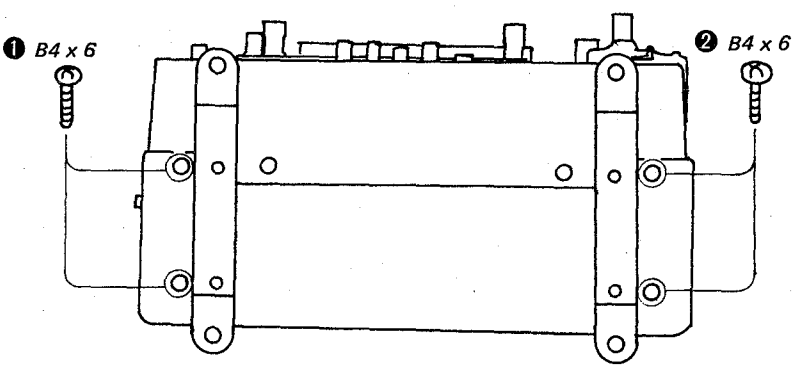


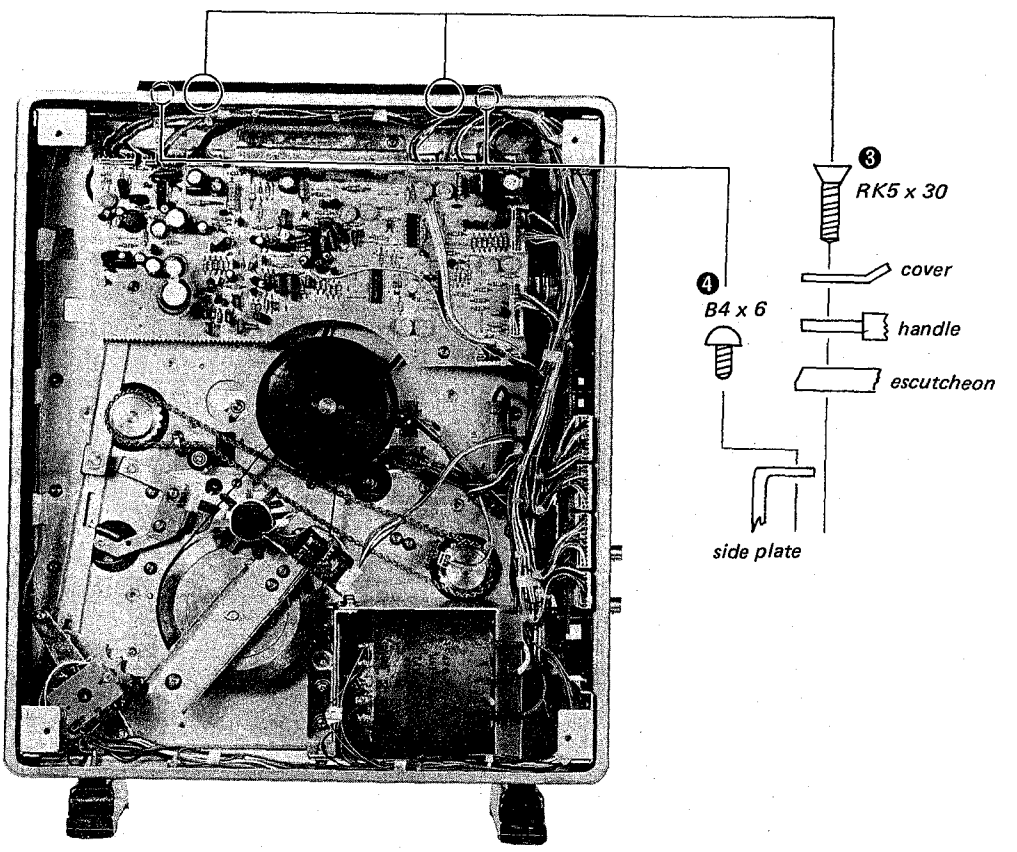
FRONT PANEL REMOVAL



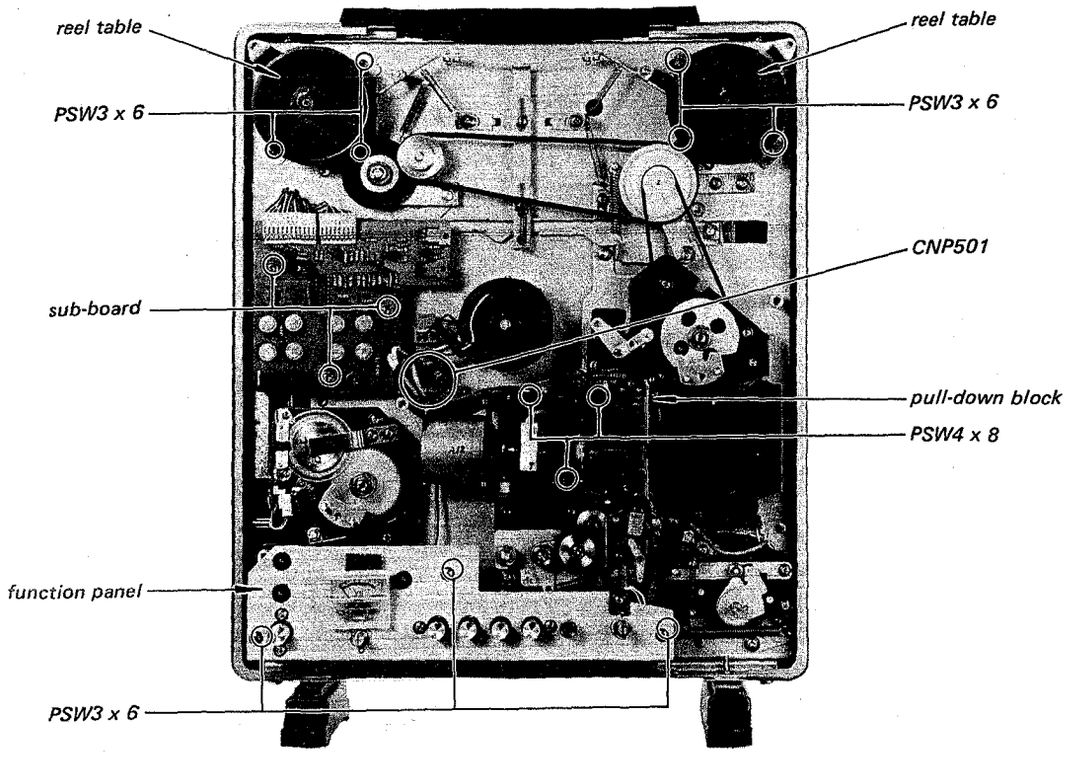


SIDE PANEL REMOVAL

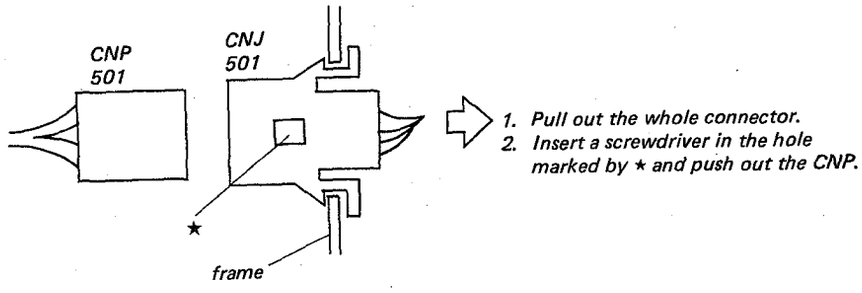




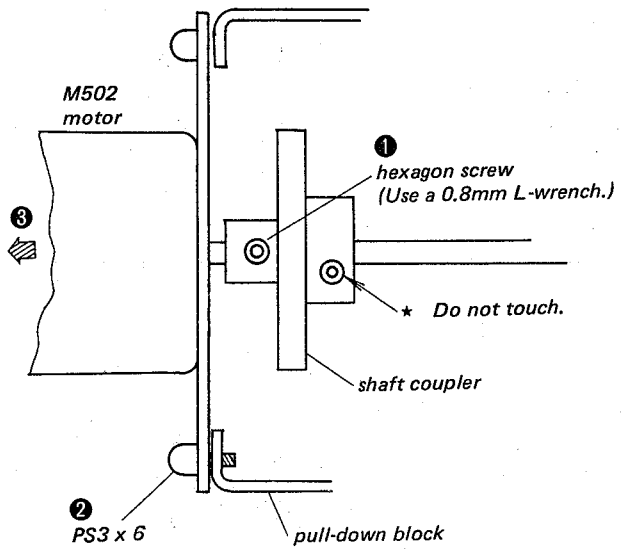
SUB-BOARD, FUNCTION PANEL, PULL-DOWN BLOCK AND REEL TABLE REMOVAL



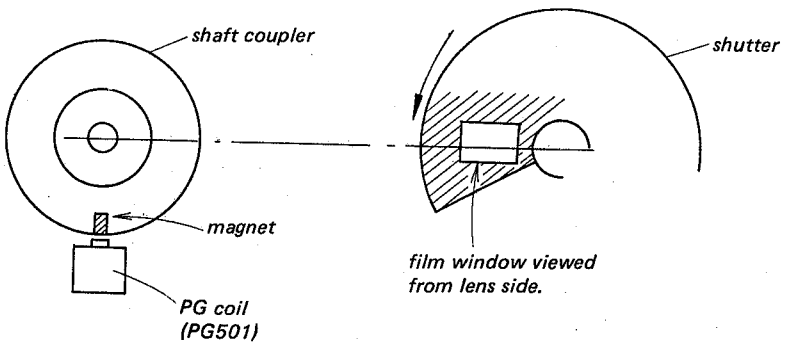
CONNECTOR REMOVAL



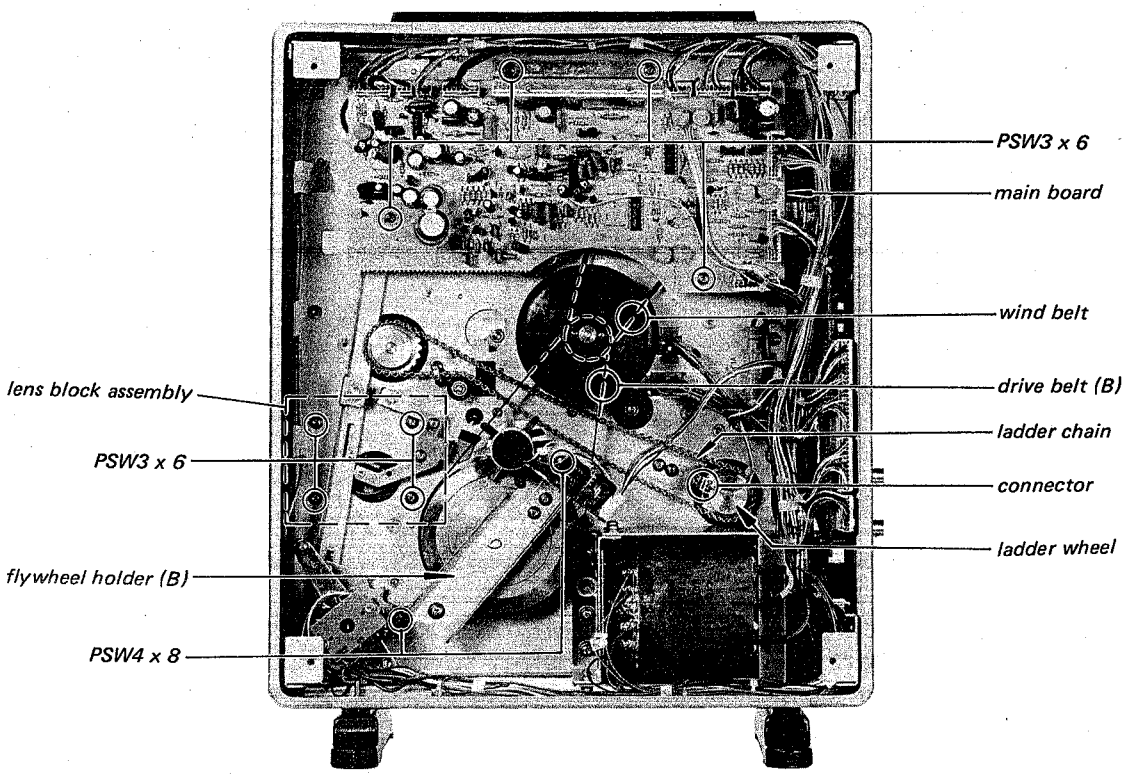
PULL-DOWN MOTOR REMOVAL

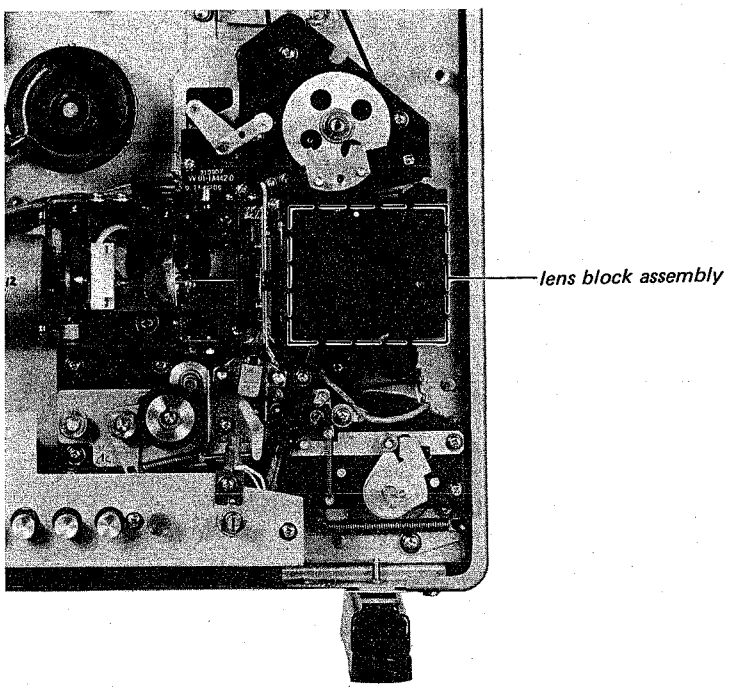


— shutter angle and shaft coupler position —

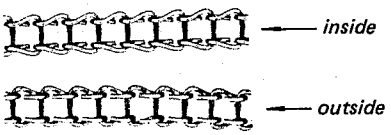


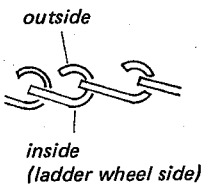
MAIN BOARD, BELT, FLYWHEEL HOLDER, CHAIN AND LENS BLOCK ASSEMBLY REMOVAL



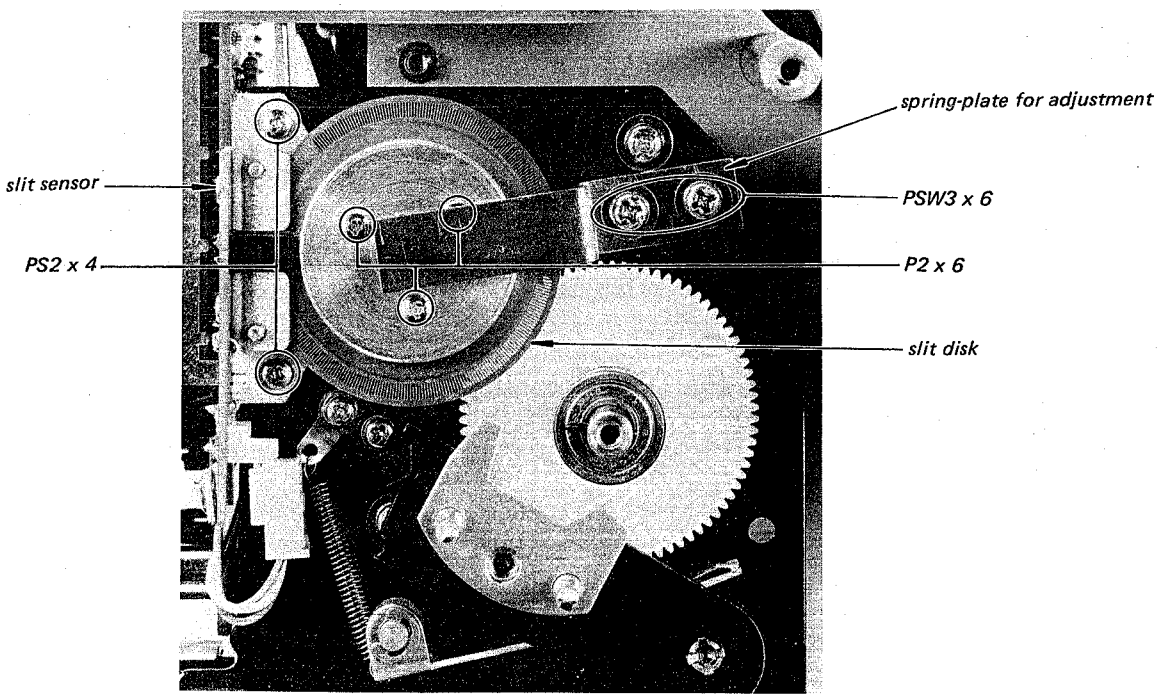


– chain –

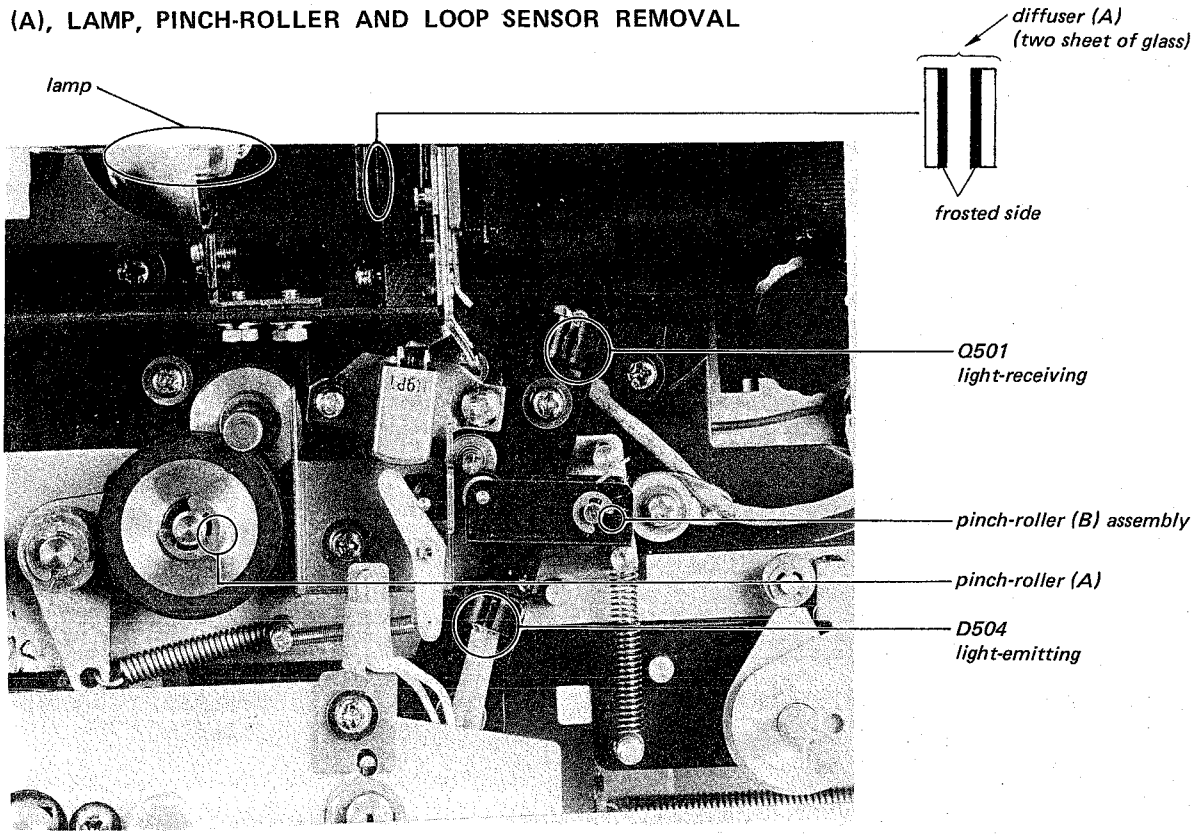




SLIT SENSOR AND SLIT DISK REMOVAL



DIFFUSER (A), LAMP, PINCH-ROLLER AND LOOP SENSOR REMOVAL

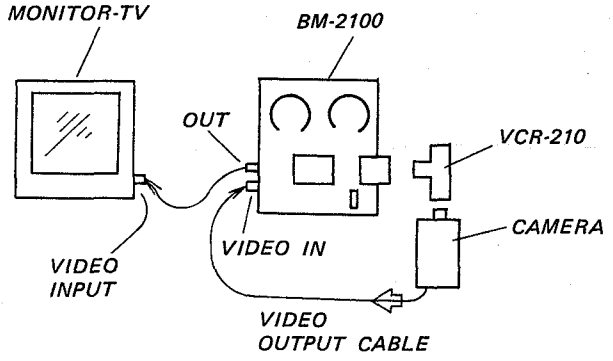


SECTION 3
ADJUSTMENTS

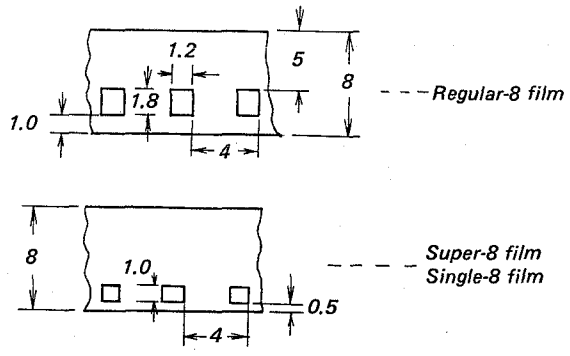
Preparation

Connect the units as shown.
(Do not connect the RM-210 till required.)

Connection



Film Type



BM-2100 SETTING

Side Connector Panel

VIDEO FIELD:	60 or 50
FILM DRIVE CONTROL:	LOCAL
VIDEO IN:	Connect the video signal from a camera.
VIDEO OUT:	Connect to a monitor TV.

Function Panel

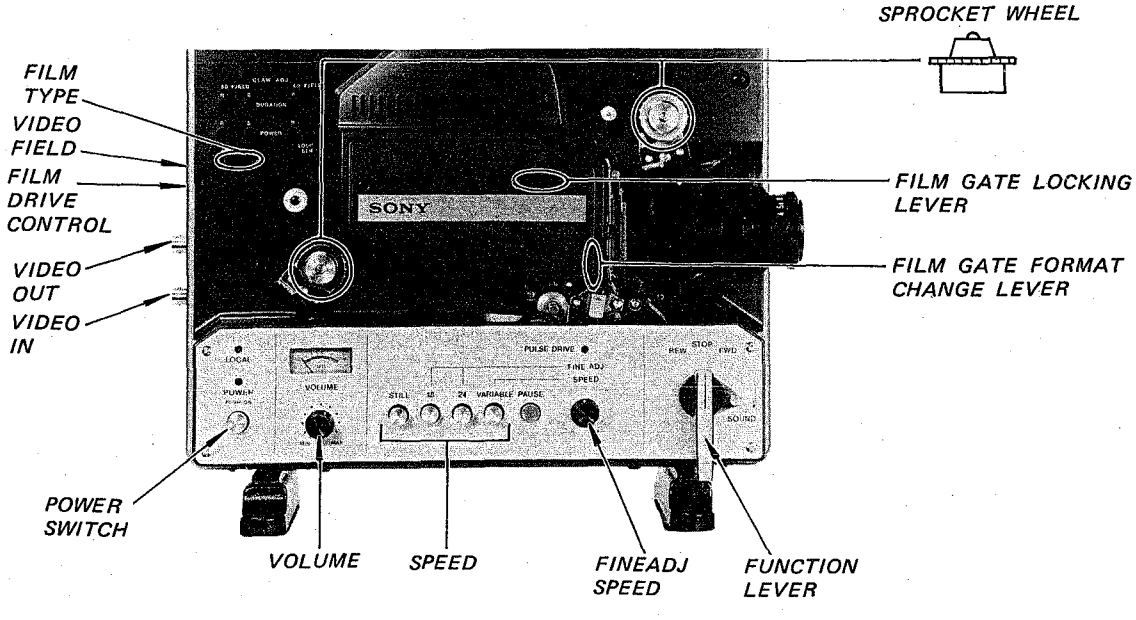
VOLUME:	MIN
SPEED:	Depress 24.
FINE ADJ/SPEED:	Center Position
FUNCTION LEVER:	STOP

Front Panel

FILM TYPE:	S for super-8 and single-8 films R for regular-8 films
SPROCKET WHEEL:	White coloured one for super-8 and single-8 films Black coloured one for regular-8 films

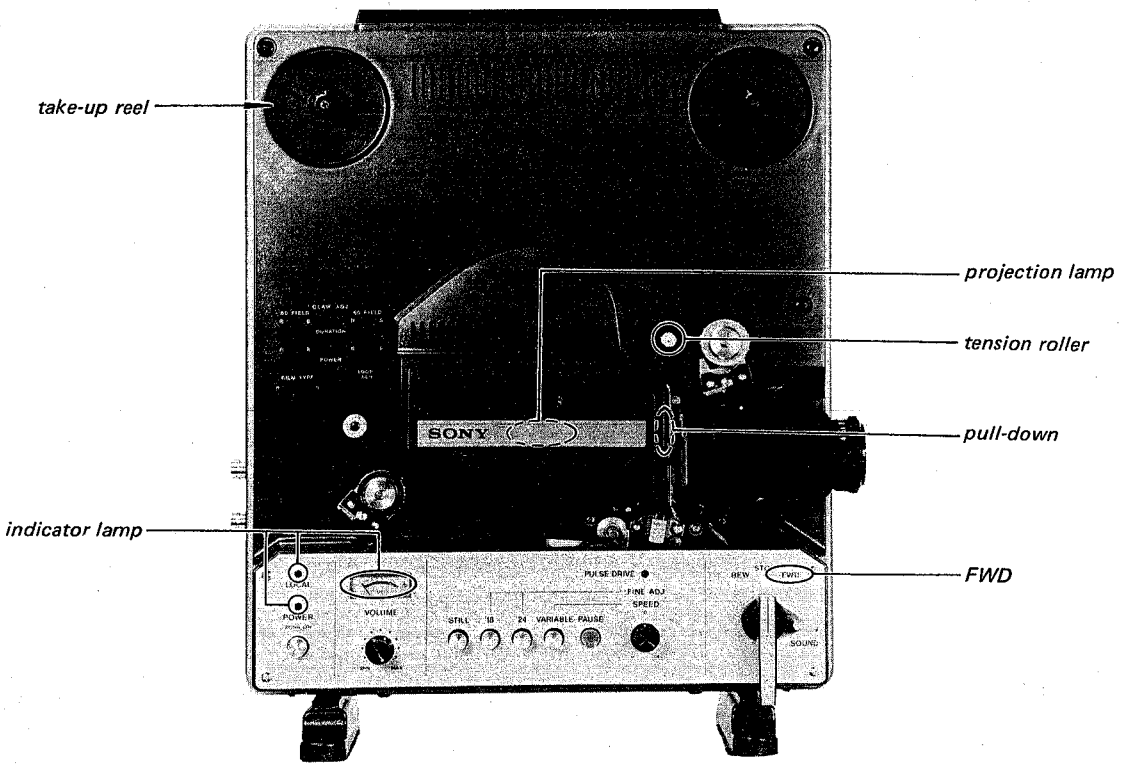
Lamp Housing Cover

FILM GATE LOCKING LEVER:	Set to the right side position.
FILM GATE FORMAT CHANGE LEVER:	S for super-8 and single-8 films R for regular-8 films

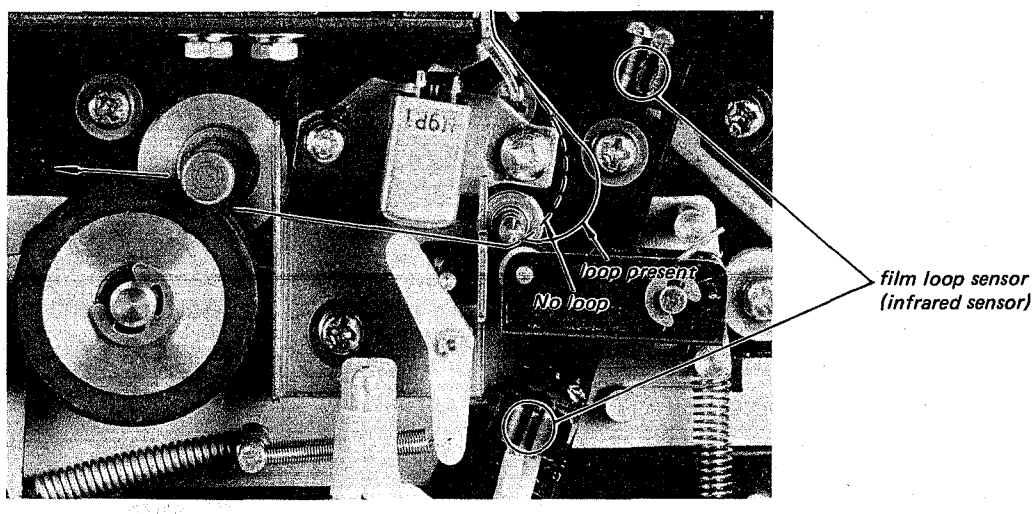


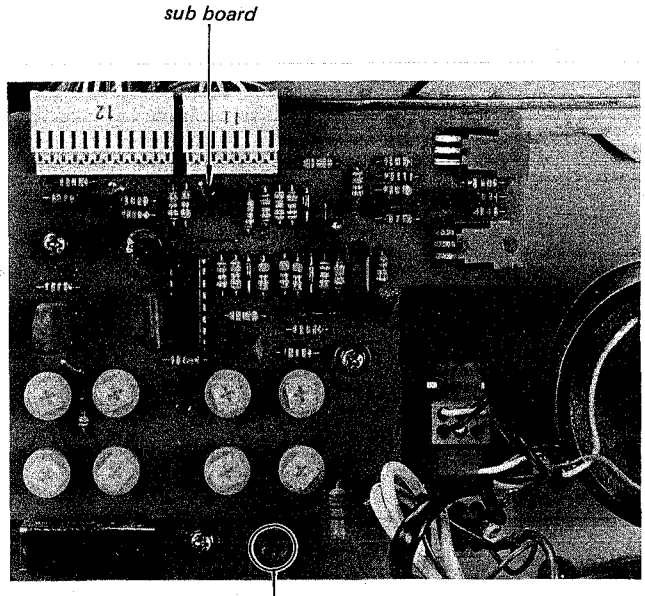
Operation Check

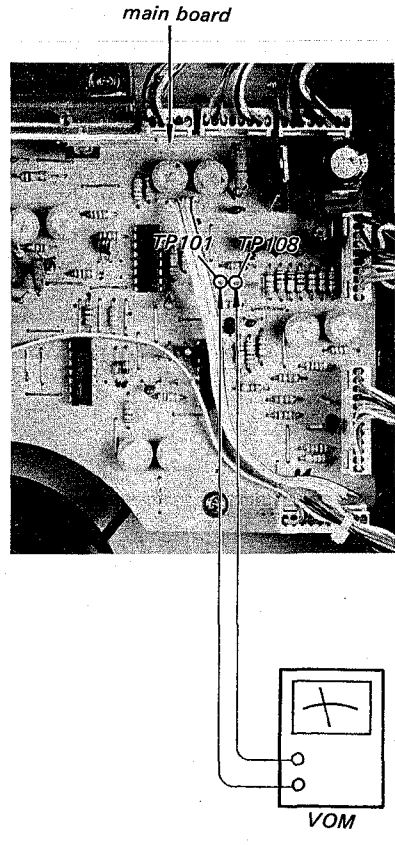
1. Turn on the POWER switch. The pilot lamp and LOCAL indicator will light up.
2. Set the Function Lever to FWD. The take-up reel rotates and both the feed and take-up sprockets rotate clockwise. Pull-down noises can be heard.
3. Remove the lamp housing cover. Confirm that the cooling fan is rotating.
4. In FWD mode, press down the tension roller by fingers. No pull-down noises can be heard.



Film Loop Sensor Adjustment







Film Loop Sensor Adjustment

Procedure:

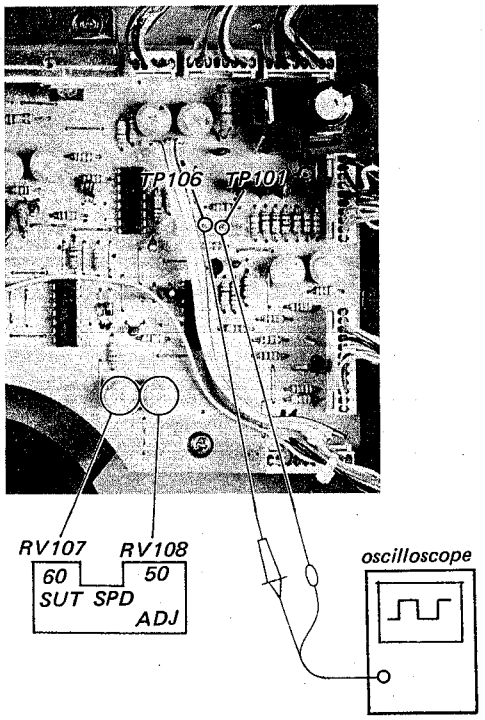
1. Set to FWD mode with no film in the machine and adjust RV209 so that the voltage at TP108 is 3.8V.
2. Make sure that the voltage at TP108 is approximately 0V when the loop sensor is blocked by a finger.
3. Push the tension roller down and make sure that the voltage at TP108 disappears.

VIDEO/PG Lock Adjustment

– Synchronizing the shutter with TV field –

Setting:

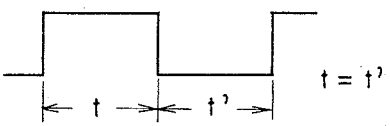
1. Depress the STILL button.
2. No film in the machine.
3. Select 50 or 60 with the VIDEO FIELD selector for TV field system.
4. Connect the video signal from the camera to the VIDEO IN connector.
5. Turn on the camera.

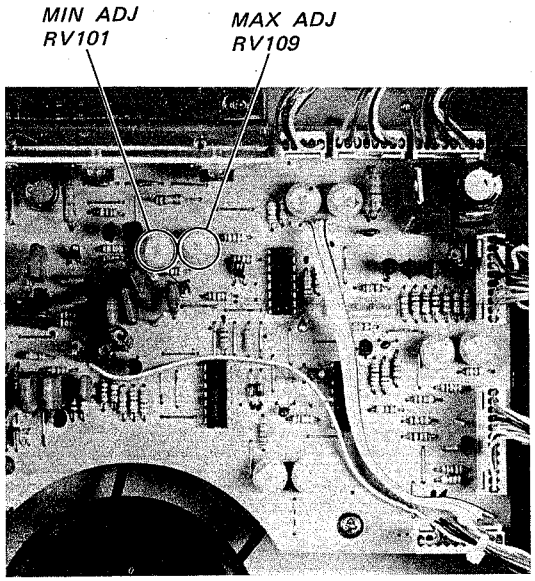


Procedure:

1. Connect an oscilloscope to TP106 and TP101 as illustrated.
2. Set the Function Lever to FWD.
3. While observing the 6Vp-p square waveform displayed on the oscilloscope, adjust RV107 (for 60 field system) or RV108 (for 50 field system) so that a duty factor of the waveform is 50 to 50.
   (When no video signal comes in, there is no waveform.)

Note: SYNC pulses of the video signal from a camera is more than 0.3Vp-p.





VARIABLE Adjustment

Setting:

1. Depress the VARIABLE button of the BM-2100.
2. Turn the FINE ADJ SPEED control of the RM-210 fully counterclockwise.
3. Connect the camera to the VIDEO IN connector of the BM-2100 and turn on the camera.
4. Connect the RM-210 to the BM-2100.
5. Set the PLL TIME BASE selectors of the RM-210 to VIDEO and select 50 or 60 (for TV field system.)
6. Set the FLIM DRIVE CONTROL selector of the BM-2100 to LOCAL.
7. Thread the film and set the Function Lever to FWD.

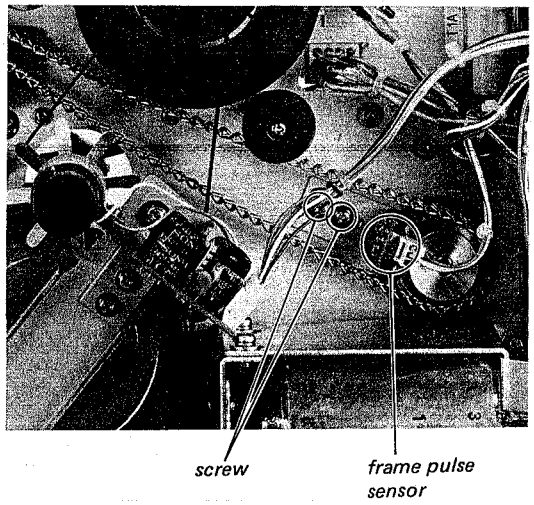
Procedure:

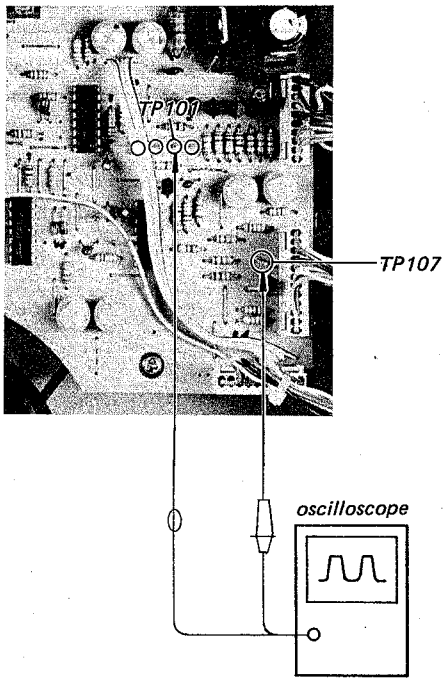
1. Adjust RV101 so that the film starts to run when the FINE ADJ SPEED control is turned 30° clockwise from "0" (center position).
2. Adjust RV109 so that the film speed indicator of the RM-210 shows as follows when the FINE ADJ SPEED control is turned fully clockwise.
   43 frames/sec. when the super-8 film is used.
   48 frames/sec. when the regular film is used.

Frame Pulse Generator Adjustment

Setting:

No film in the machine
Projection speed: 24
Mode: FWD





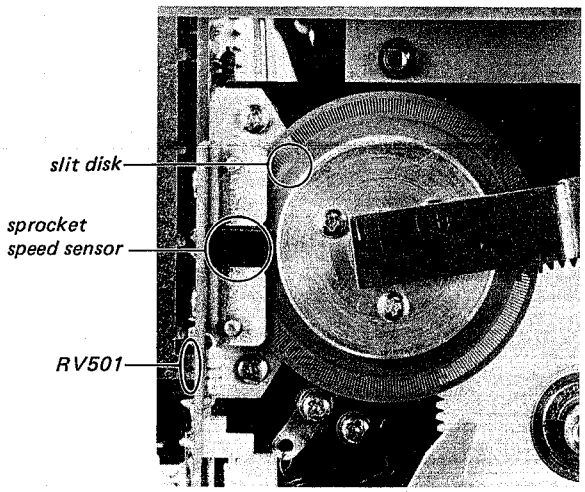
Procedure:

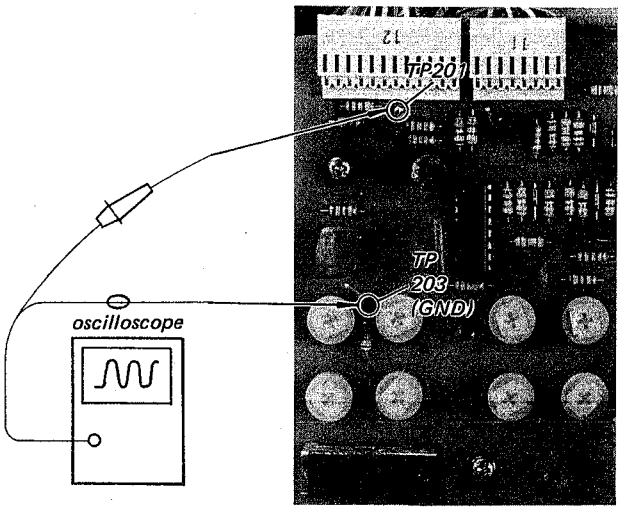
Adjust the position of the sensor so that the waveform is observed as illustrated.

Sprocket Speed Generator Adjustment

Setting:

No film in the machine
Projection speed: 24
Mode: FWD

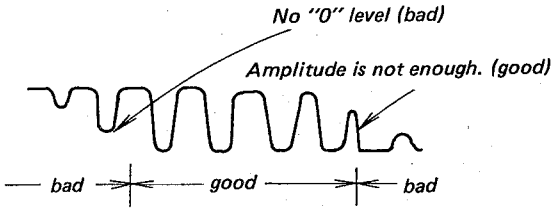




Procedure:

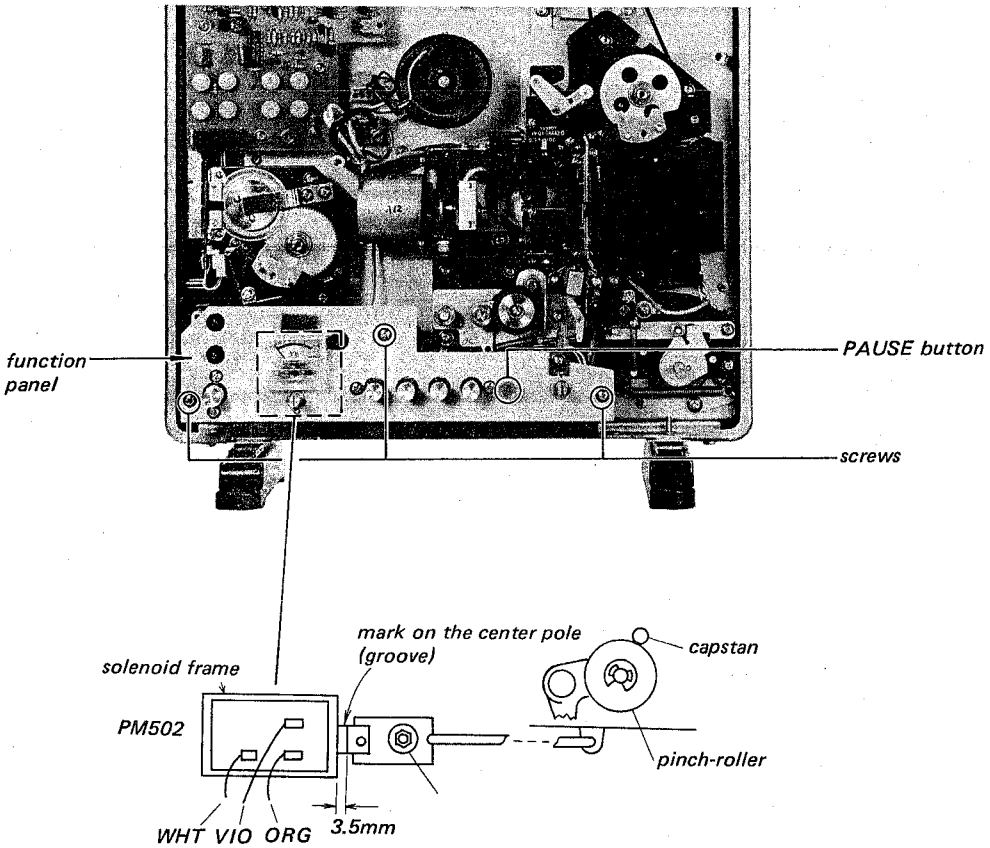
Adjust RV501 to obtain the maximum amplitude waveform.

Note: When the RM-210 is connected, the amplitude drops 10%.



PAUSE Solenoid Adjustment

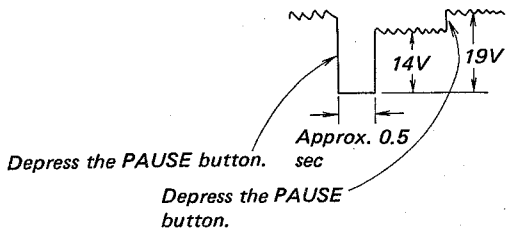
Remove the function panel.

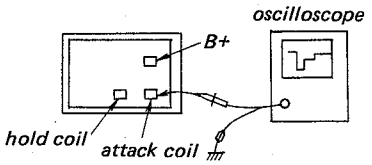


Turn off the POWER switch and set the Function Lever to FWD.

Procedure:

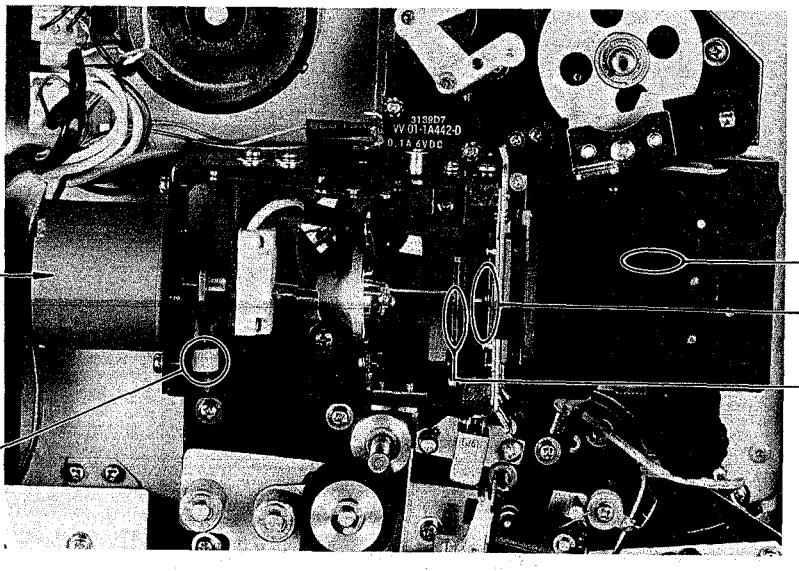
1. Loosen the screw marked by ★ and adjust the center pole so that the mark (groove) is positioned at the distance of 3.5mm from the solenoid frame.
2. Tighten the screw.
3. Turn on the POWER switch.
4. Depress the PAUSE button and make sure that the pinch-roller comes off 1mm from the capstan and the groove on the center pole is pulled in the solenoid fram.



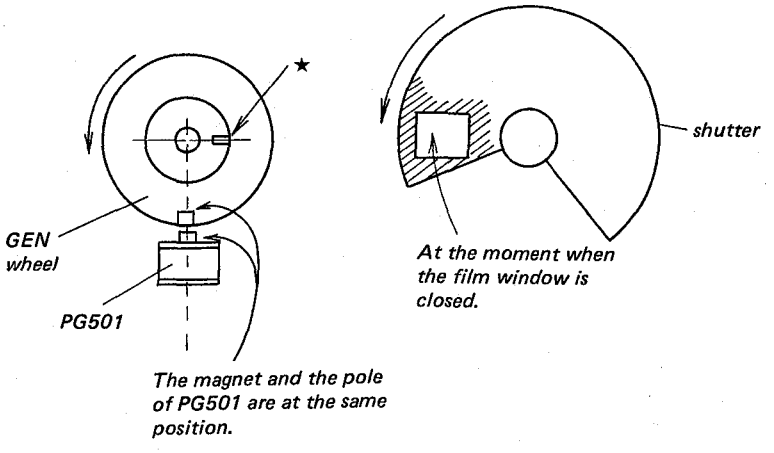


5. When the center pole is not pulled in even though the PAUSE button is depressed, check voltages as illustrated.
6. When it is not 0V for 0.5sec, check the attack circuit Q205 – 208 in the sub board.
   When it is not 14V, check the hold circuit Q203 – 204 in the sub board.

PG Position Adjustment for Synchronizing with Shutter



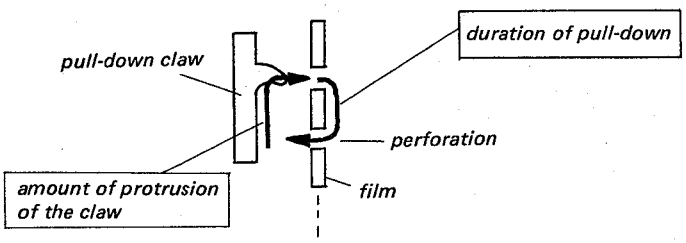
Use a 1.27mm L-wrench.


★
GEN wheel
PG501
The magnet and the pole of PG501 are at the same position.
shutter
At the moment when the film window is closed.

When the film window, viewed from the lens side, is completely closed, the magnet faces to face with the pole of the PG coil.

Procedure:

1. Adjust the magnet position by loosening the screw marked by ★ so that the magnet faces to face with the pole of the PG coil just when the film window, viewed from lens side, is completely closed.
2. After adjustments, tighten the screw.

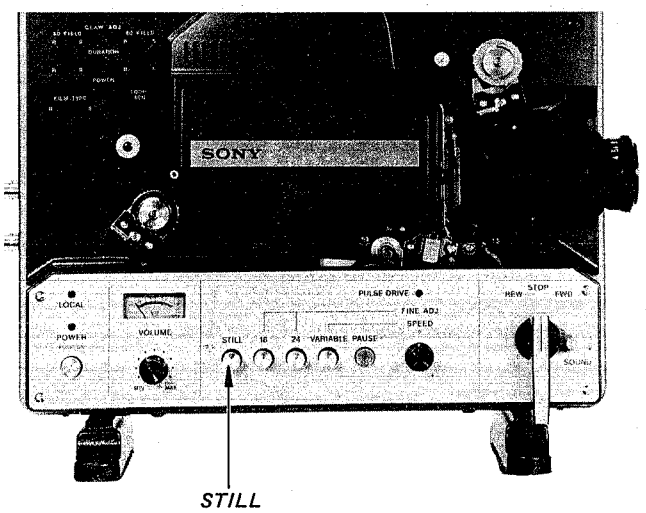


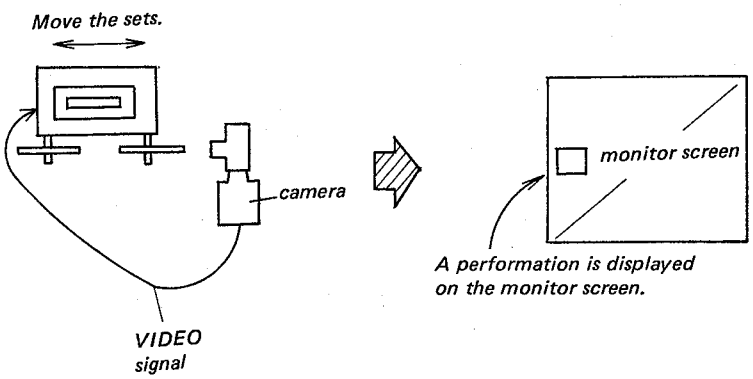
Film Pull-down Adjustment

The claw reciprocates along with the shutter and is energized when currents are supplied to the solenoid PM501. Its operation is as follows.

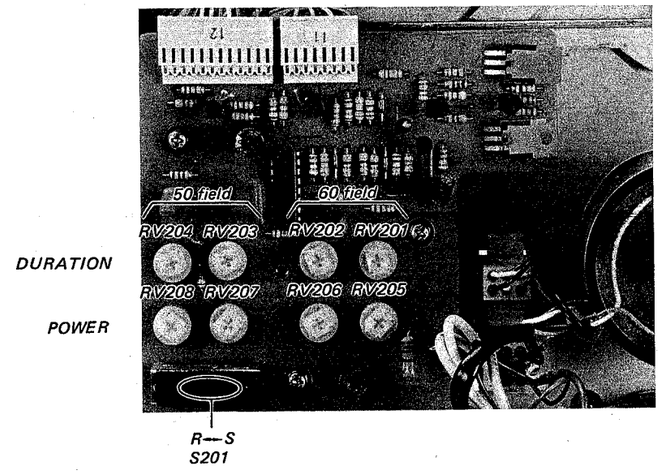
a. The mount of the current supplied to PM501 controls the protrusion of the claw.
b. The period of the time of which the current supplied to PM501 controls the duration of the claw protrusion.

In STILL mode, move the unit left or right so that a perforation is displayed on the monitor.





Depress the VARIABLE button and set the Function Lever to FWD.
Turn the FINE ADJ SPEED control and verify that the picture is stable at any projection speed.
When the picture is unstable, perform the adjustments.



Setting:

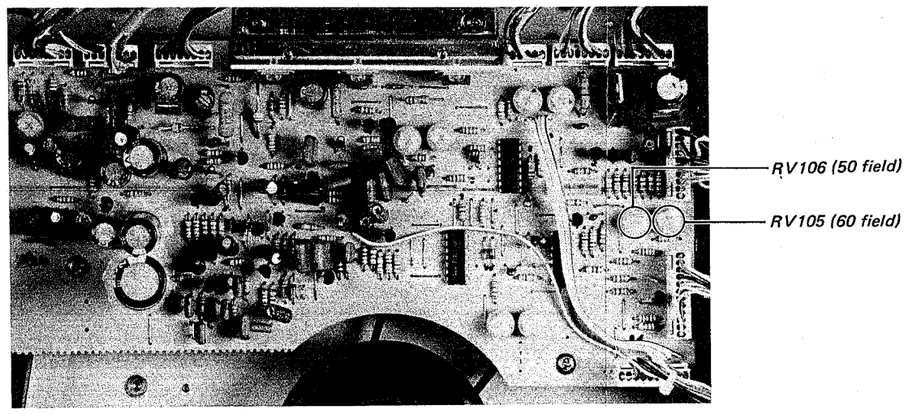
1. Depress the VARIABLE button.
2. Set the FINE ADJ SPEED control at 10 frames/sec. and the Function Lever to FWD.
3. Select one pair of combination listed on the following table.

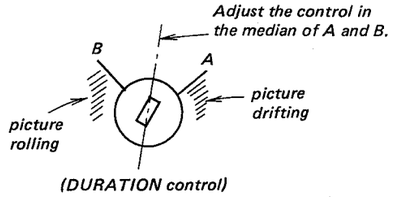
	50 field		60 field	
	regular-8	super-8 single-8	regular-8	super-8 single-8
DURATION	RV204	RV203	RV202	RV201
POWER	RV208	RV207	RV206	RV205

4. Set the FILM TYPE selector to
   R: for regular-8 films
   S: for super-8 and single-8 films
   Set the VIDEO FIELD selector to
   50: for a 50-field system
   60: for a 60-field system
   Attach the take-up sprocket wheel and the feed sprocket wheel for either regular-8 film type or super-8/single-8 type.

DL50/60 Adjustment

Normally, RV105 and RV106 are set at the center position. When the picture is still unstable, adjust RV105 (for 60 field) or RV106 (for 50 field).





Procedure:

1. Turn the POWER control clockwise and stop it before the picture starts to drift.
2. Turn the DURATION control and find a point (A) where the picture starts to drift.
3. Turn the DURATION control and find a point (B) where the picture starts to roll.
4. Set the DURATION control in the median of the two points (A, B).
5. Turn the FINE ADJ SPEED control to vary the projection speed and verify that the picture is stable at any projection speed.

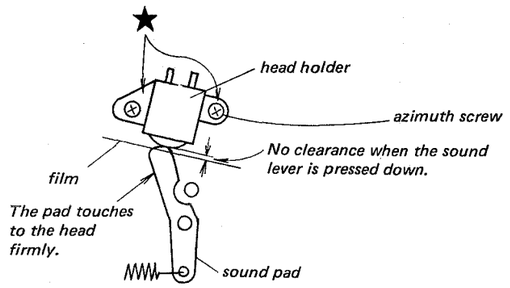
Sound Check

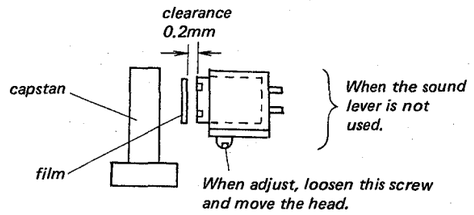
Setting:

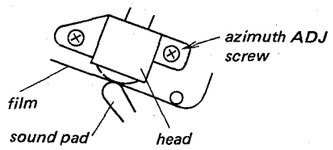
1. Thread the film with recorded sound track in the set.
2. Set the SPEED control to center position.
3. Depress the 18 button.
4. Connect stereo binaural headphones to the AUDIO OUT jack.
5. Set the Function Lever to FWD.
6. Press down the Sound Lever.
7. Set the VOLUME to MAX.

When the high frequency sound can not be played back, check as follows.

If the film does not touch the head, loosen the screws marked by ★ and adjust the head position as shown below.

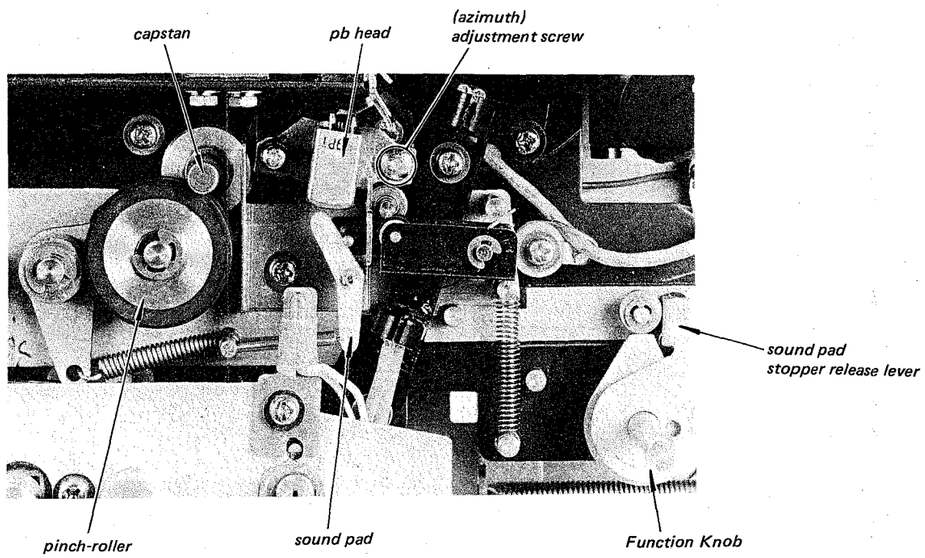






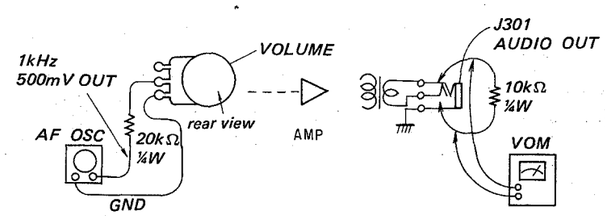
Film Pull-down Motor

When the motor is replaced, adjust the positions of the shutter and the PG coil.



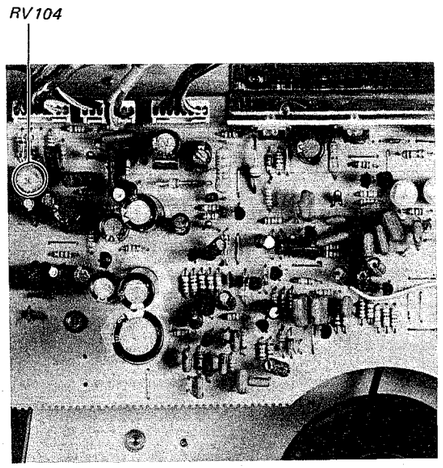
Meter Adjustment

Setting: Connect as illustrated.



Procedure:

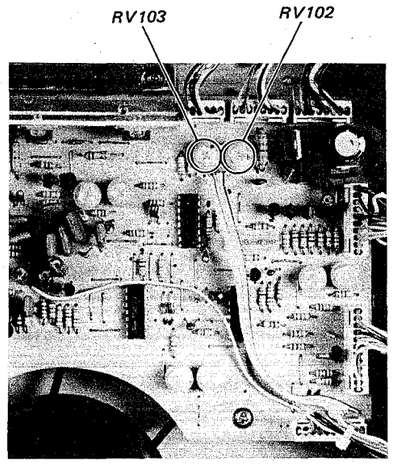
1. Turn the VOLUME so that a VOM reading is –5dB.
2. Adjust RV104 so that a VU meter reading is "0".



Projection Speed Adjustment

Setting:

1. Depress "18" or "24" button for projection speed.
2. Set the FILM DRIVE CONTROL selector to LOCAL.
3. Thread the film.
4. Connect the RM-210 and the camera.



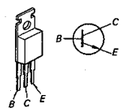
Adjust RV103 so that the RM-210 displays 18 when the projection speed button "18" is depressed.
Adjust RV102 so that the RM-210 displays 24 when the projection speed button "24" is depressed.

SECTION 4
DIAGRAMS

Replacement Semiconductors

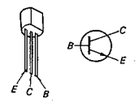
For replacement, use semiconductors except in ( ).

Q102, 103, Q106, 208 : 2SC1061
Q101 : 2SD476A

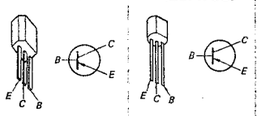


Q104, 107–115, Q117, 118, Q120–123, 125, Q201–203, Q205–207 : 2SC1364

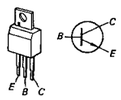
Q126 : 2SC1362 (2SC1364)



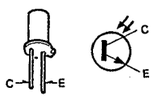
Q105, 124: 2SA1027R (2SA733)



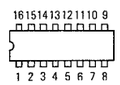
Q116, 119, 204: 2SC1124



Q501: TPS601

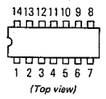


IC108: TC4049BP (MC14049)
IC107: MC14538BCP
IC201: MC14572UBCP



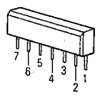
IC103: CX069

IC106: TC4013BP (MC14013)

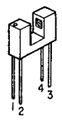


IC101: TA7139P

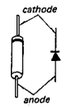
IC104: TA7140P



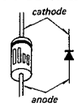
IC501, 502: SPI201



D106, 107, 111, 112 : 1T22AM
D113, 114 : RD6.8E-C
D115, 116, 301, 503 : 10E2 (10E1)
D104, 105, 108, 109, D110, 201–204 : 1S1555

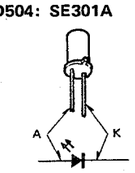


D103: EQB01-08 (RD6.8E)



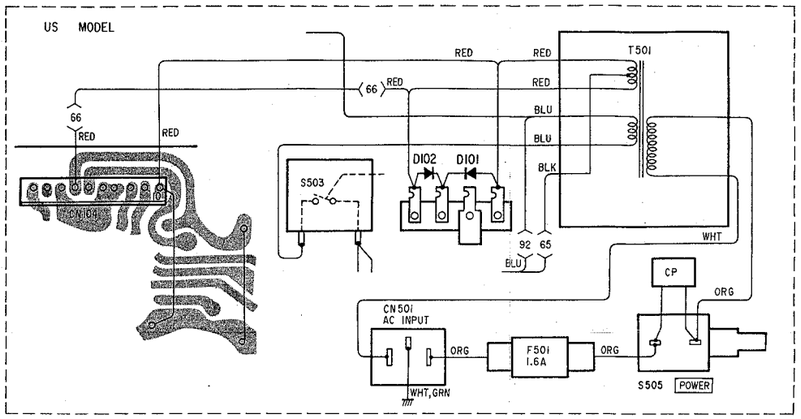
D101, 102: U05G

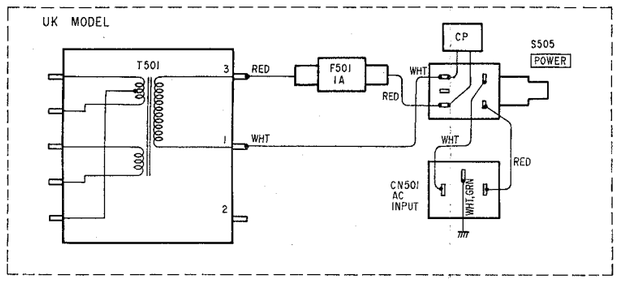
D504: SE301A

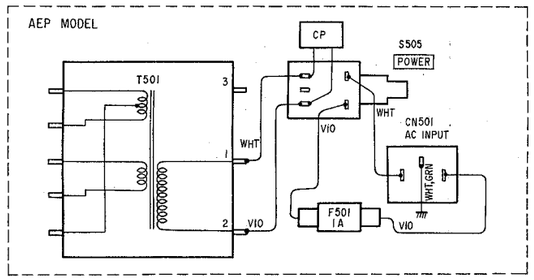


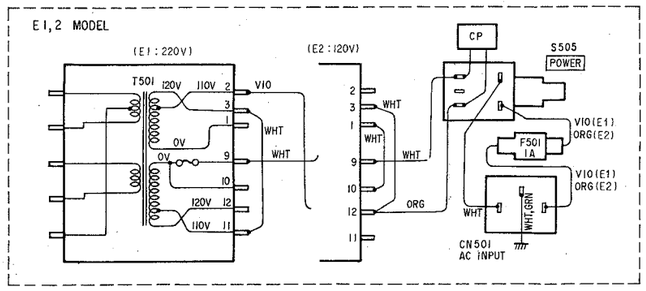
4-1. MOUNTING DIAGRAM

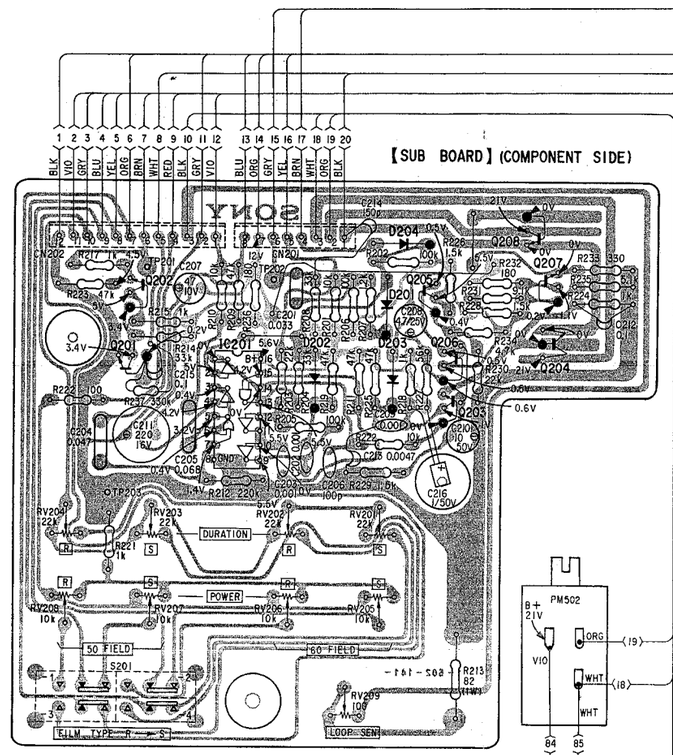
– Component Side –

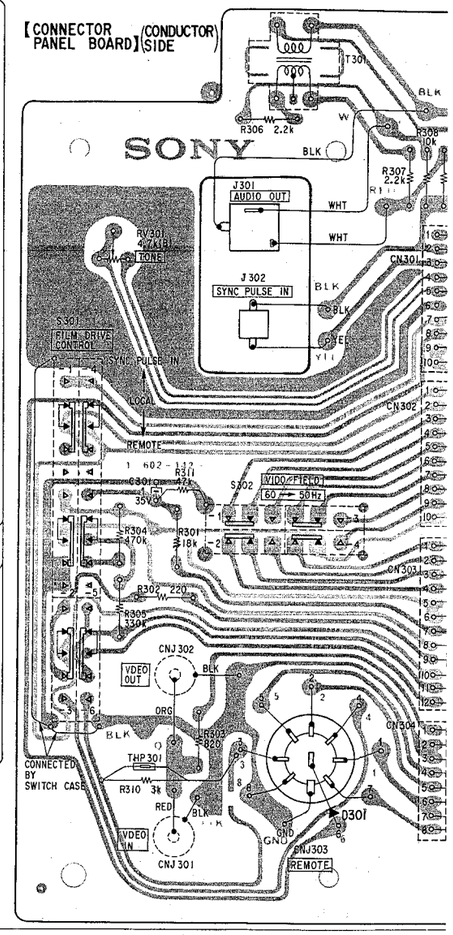


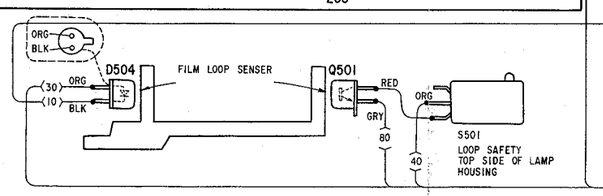


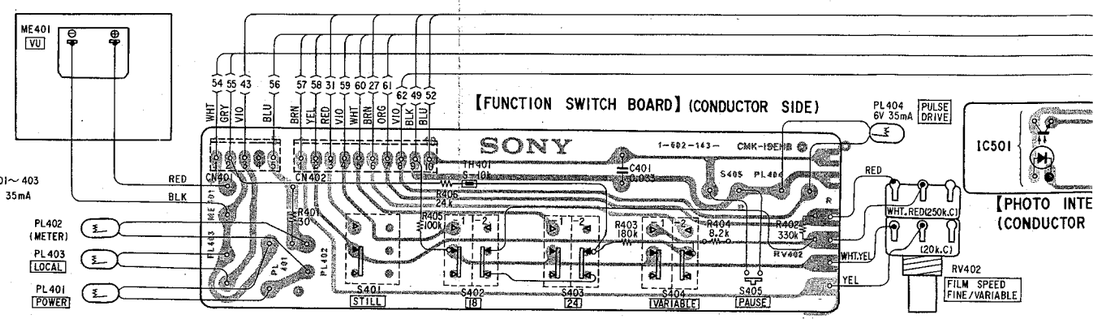


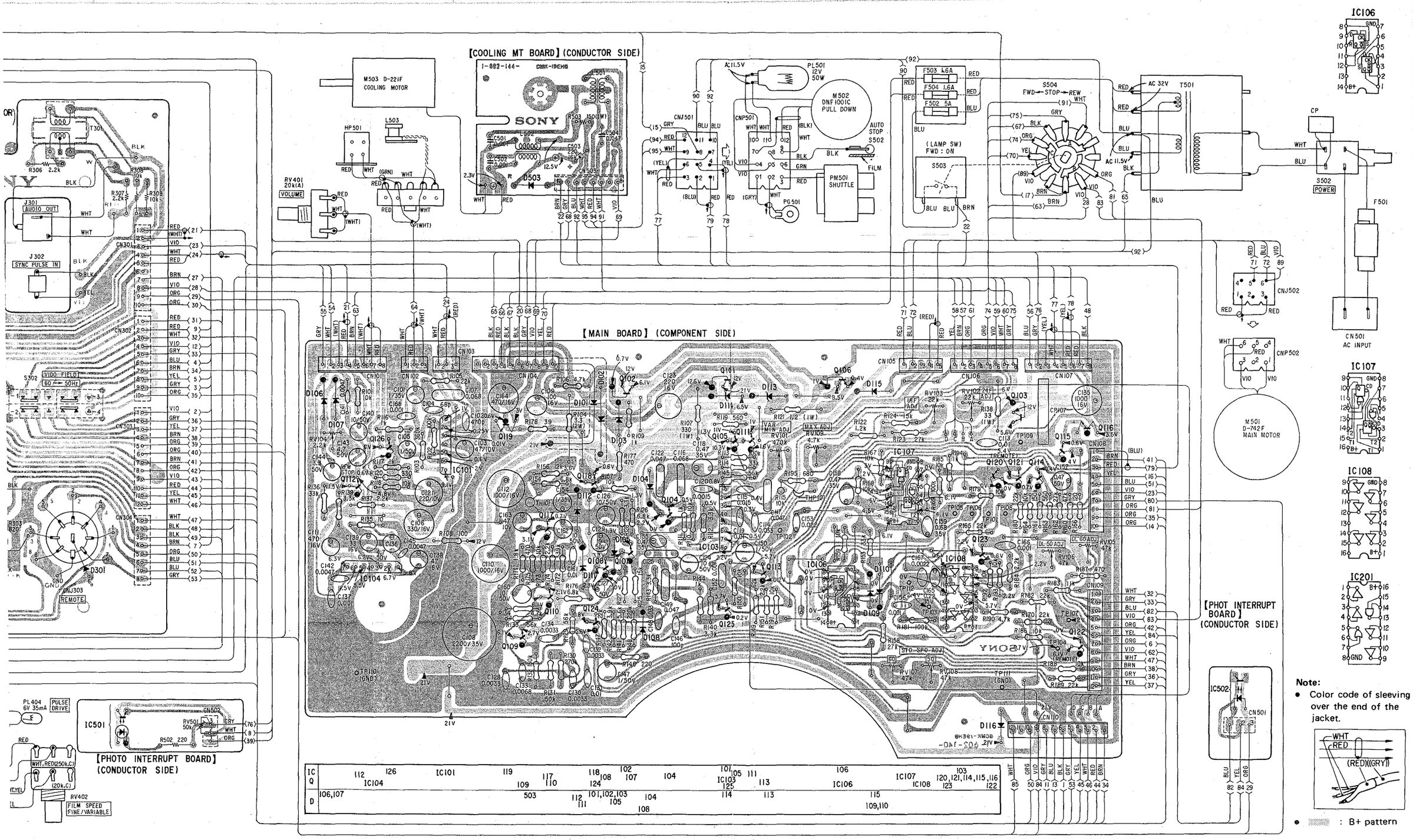











【COOLING MT BOARD】(CONDUCTOR SIDE)
【MAIN BOARD】(COMPONENT SIDE)
【PHOT INTERRUPT BOARD】(CONDUCTOR SIDE)
【PHOT INTERRUPT BOARD】(CONDUCTOR SIDE)
M503 D-221F COOLING MOTOR
RV401 20k(A) VOLUME
PL501 12V 50W
M502 DNF1001C PULL DOWN
AUTO STOP
S502
PM501 SHUTTLE
PG501
FILM
(LAMP SW) FWD : ON
S503
S504 FWD ← STOP → REW
T501
AC 32V
AC 11.5V
CP
S502 POWER
F501
CN501 AC INPUT
CNJ502
CNP502
M501 D-742F MAIN MOTOR
IC106
IC107
IC108
IC201
J301 AUDIO OUT
J302 SYNC PULSE IN
CNJ303 REMOTE
S302 VIDEO FIELD 60 ⇔ 50Hz
PL404 6V 35mA PULSE DRIVE
IC501
RV402 FILM SPEED FINE/VARIABLE
IC502
Q101
Q102
Q103
Q104
Q105
Q106
Q107
Q108
Q109
Q110
Q111
Q112
Q113
Q114
Q115
Q116
Q117
Q118
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Q120
Q121
Q122
Q123
Q124
Q125
Q126
Q127
IC101
IC103
IC104
IC108
D101
D102
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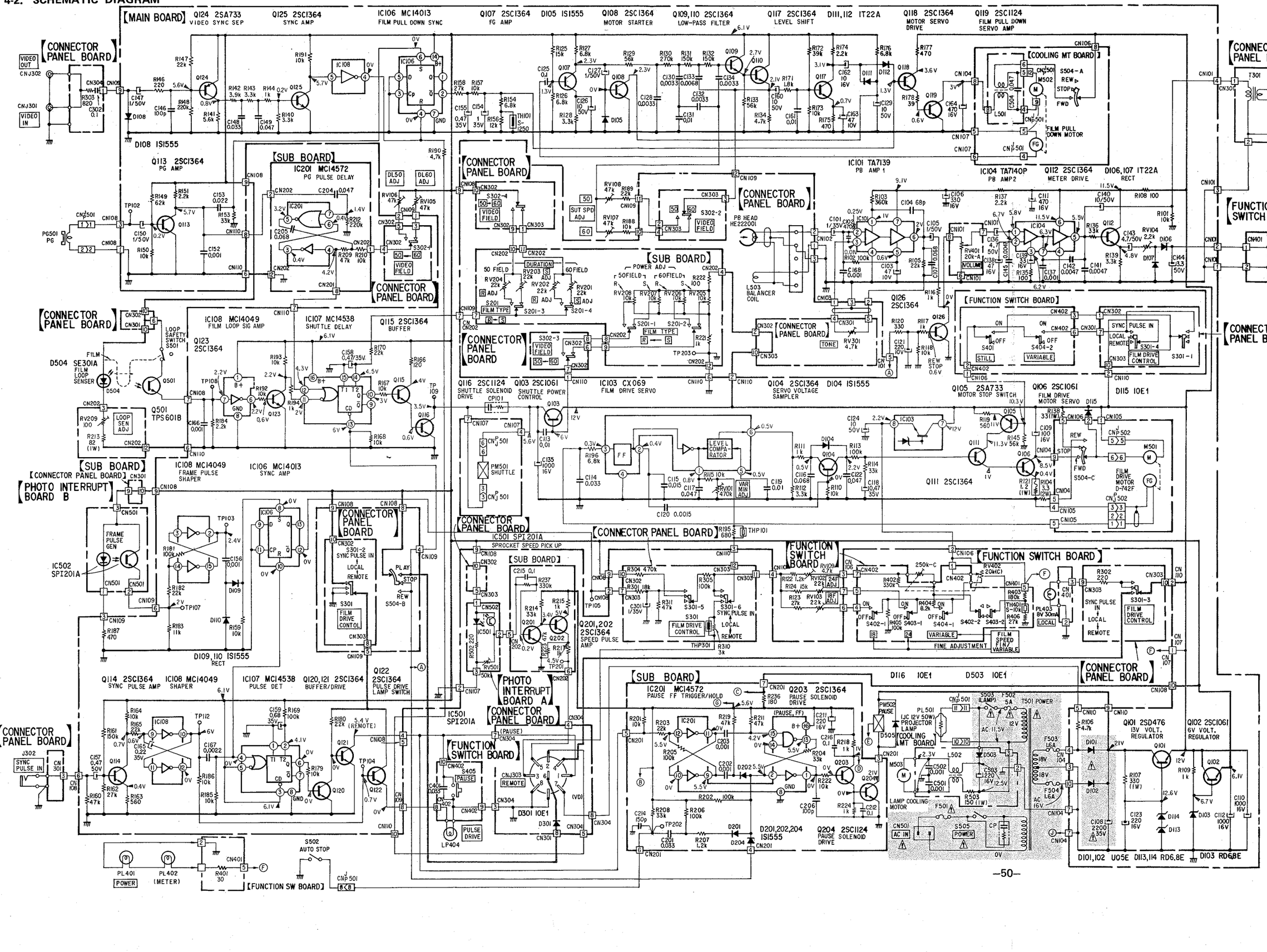
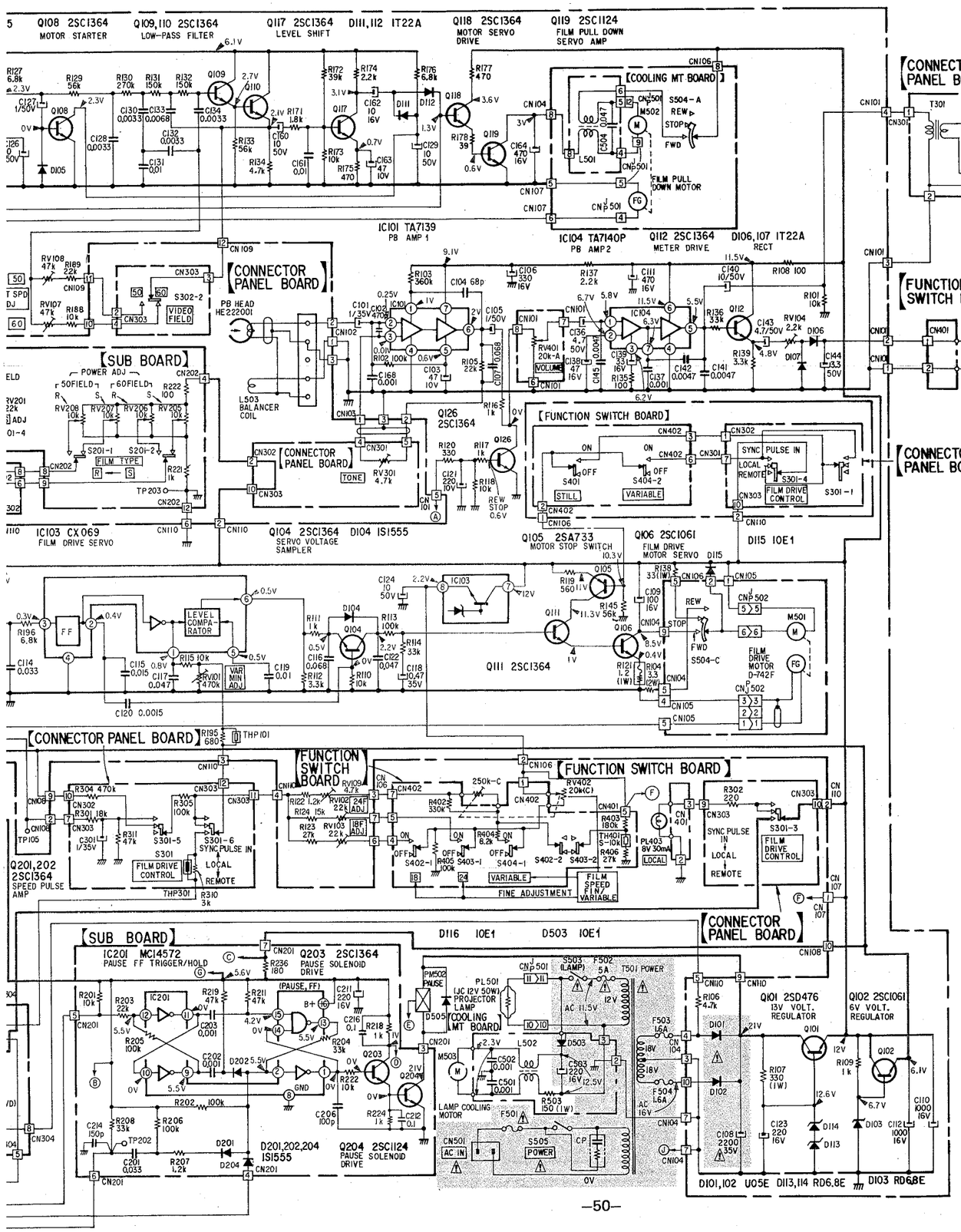
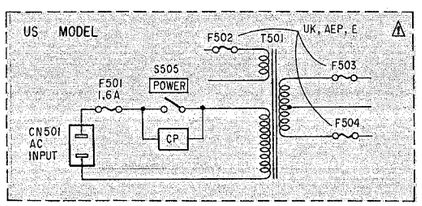
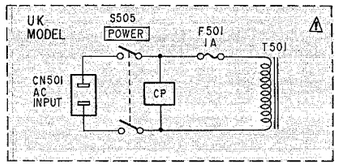
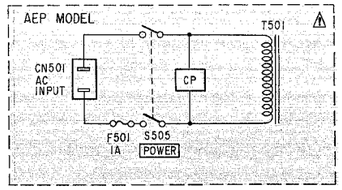
4-2. SCHEMATIC DIAGRAM

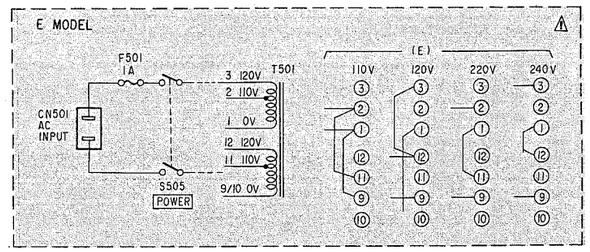


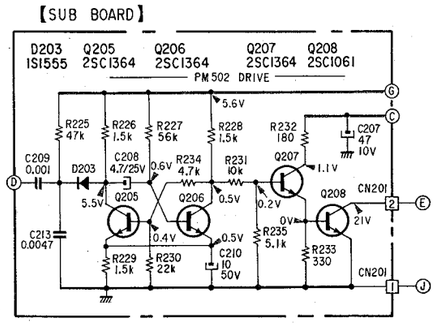












Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

Note:

- Waveforms are taken in FWD mode with switches set as follows.

VIDEO FIELD:	60
FINE ADJ (SPEED):	18
SPEED:	0 (center click)
FILM DRIVE CONTROL:	LOCAL
FILM TYPE:	S

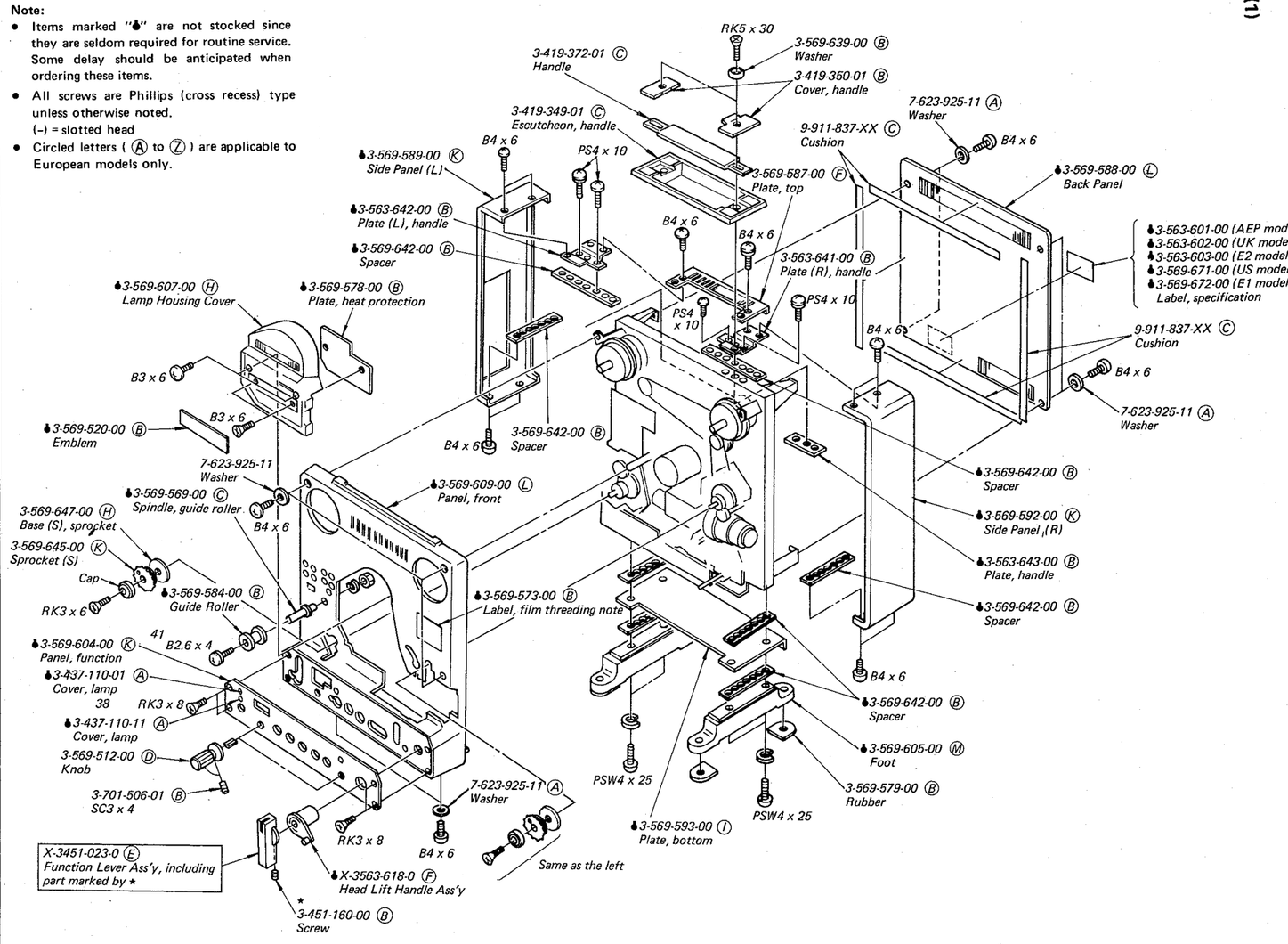
  "STOP" indicates the function switch is set to STOP position.
- All capacitors are in μF unless otherwise noted. pF = μμF 50WV or less are not indicated except for electrolytics.
- All resistors are in ohms, ¼W unless otherwise noted. kΩ : 1000Ω; MΩ : 1000kΩ
- All variable and adjustable resistors have characteristic curve B, unless otherwise noted.
- ⏦: fusible resistor.
- Voltages are dc with respect to ground unless otherwise noted.
- Voltage variations may be noted due to normal production tolerances.
- Switch

Ref. No.	Switch	Position
S201	FILM TYPE	S
S301	FILM DRIVE CONTROL	SYNC PULSE IN
S302	VIDEO FIELD	60
S401	STILL	OFF
S402	SPEED CONTROL 18	OFF
S403	SPEED CONTROL 24	OFF
S404	SPEED CONTROL VARIABLE	OFF
S405	PAUSE	OFF
S501	LOOP SAFETY	ON
S502	AUTO STOP	OFF
S503	LAMP	OFF
S505	POWER	OFF
S504	FUNCTION	STOP

- ——: B+ bus.
- □: panel designation.
- □: adjustment for repair.
- ⏚: chassis ground.

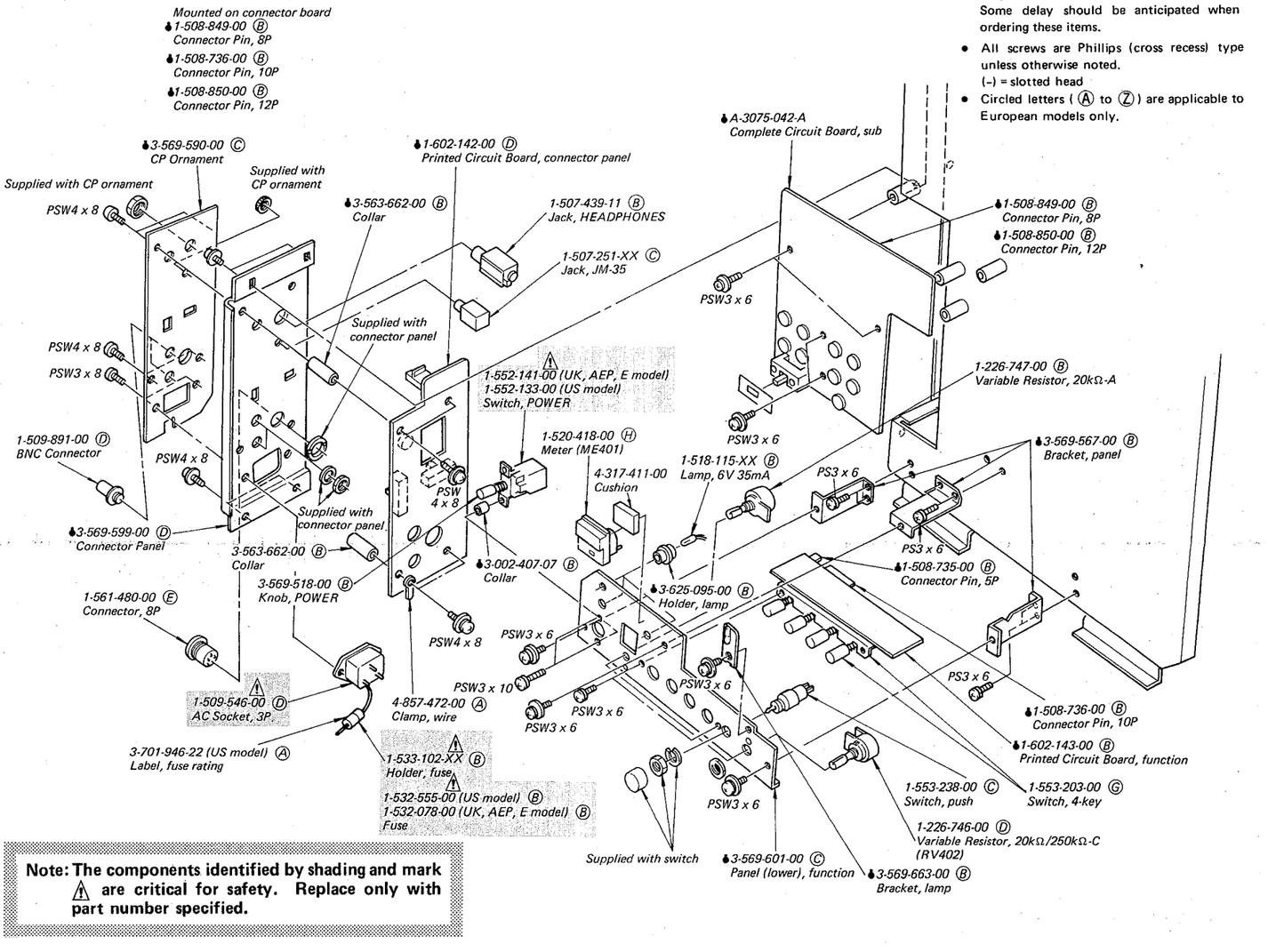
(1)

Note:
- Items marked "♦" are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (–) = slotted head
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.



(2)

Note:
- Items marked "♦" are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (–) = slotted head
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.


Mounted on connector board
♦1-508-849-00 (B) Connector Pin, 8P
♦1-508-736-00 (B) Connector Pin, 10P
♦1-508-850-00 (B) Connector Pin, 12P
♦A-3075-042-A Complete Circuit Board, sub
♦3-569-590-00 (C) CP Ornament
♦1-602-142-00 (D) Printed Circuit Board, connector panel
Supplied with CP ornament
PSW4 x 8
♦3-563-662-00 (B) Collar
1-507-439-11 (B) Jack, HEADPHONES
1-507-251-XX (C) Jack, JM-35
PSW3 x 6
♦1-508-849-00 (B) Connector Pin, 8P
♦1-508-850-00 (B) Connector Pin, 12P
Supplied with connector panel
PSW3 x 8
1-552-141-00 (UK, AEP, E model)
1-552-133-00 (US model)
Switch, POWER
1-226-747-00 (B) Variable Resistor, 20kΩ-A
1-509-891-00 (D) BNC Connector
1-520-418-00 (H) Meter (ME401)
♦3-569-567-00 (B) Bracket, panel
4-317-411-00 Cushion
1-518-115-XX (B) Lamp, 6V 35mA
PS3 x 6
PSW 4 x 8
♦3-569-599-00 (D) Connector Panel
3-563-662-00 (B) Collar
♦3-002-407-07 (B) Collar
♦1-508-735-00 (B) Connector Pin, 5P
3-569-518-00 (B) Knob, POWER
♦3-625-095-00 (B) Holder, lamp
1-561-480-00 (E) Connector, 8P
PSW3 x 10
4-857-472-00 (A) Clamp, wire
♦1-508-736-00 (B) Connector Pin, 10P
♦1-602-143-00 (B) Printed Circuit Board, function
1-509-546-00 (D) AC Socket, 3P
3-701-946-22 (US model) (A) Label, fuse rating
1-533-102-XX (B) Holder, fuse
1-532-555-00 (US model) (B)
1-532-078-00 (UK, AEP, E model) (B)
Fuse
1-553-238-00 (C) Switch, push
1-553-203-00 (G) Switch, 4-key
1-226-746-00 (D) Variable Resistor, 20kΩ/250kΩ-C (RV402)
Supplied with switch
♦3-569-601-00 (C) Panel (lower), function
♦3-569-663-00 (B) Bracket, lamp

Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

(3)

(2)

Note:
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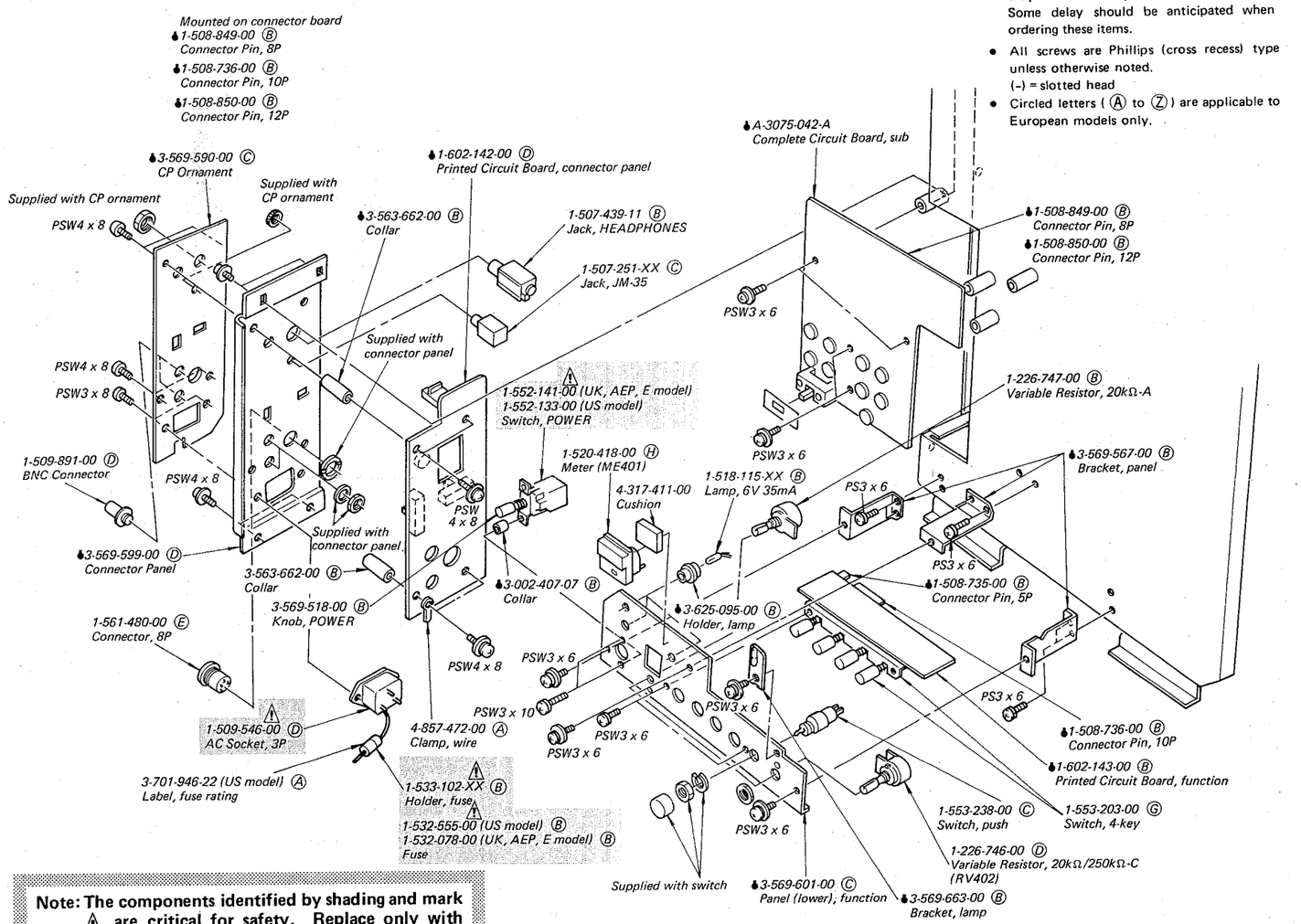
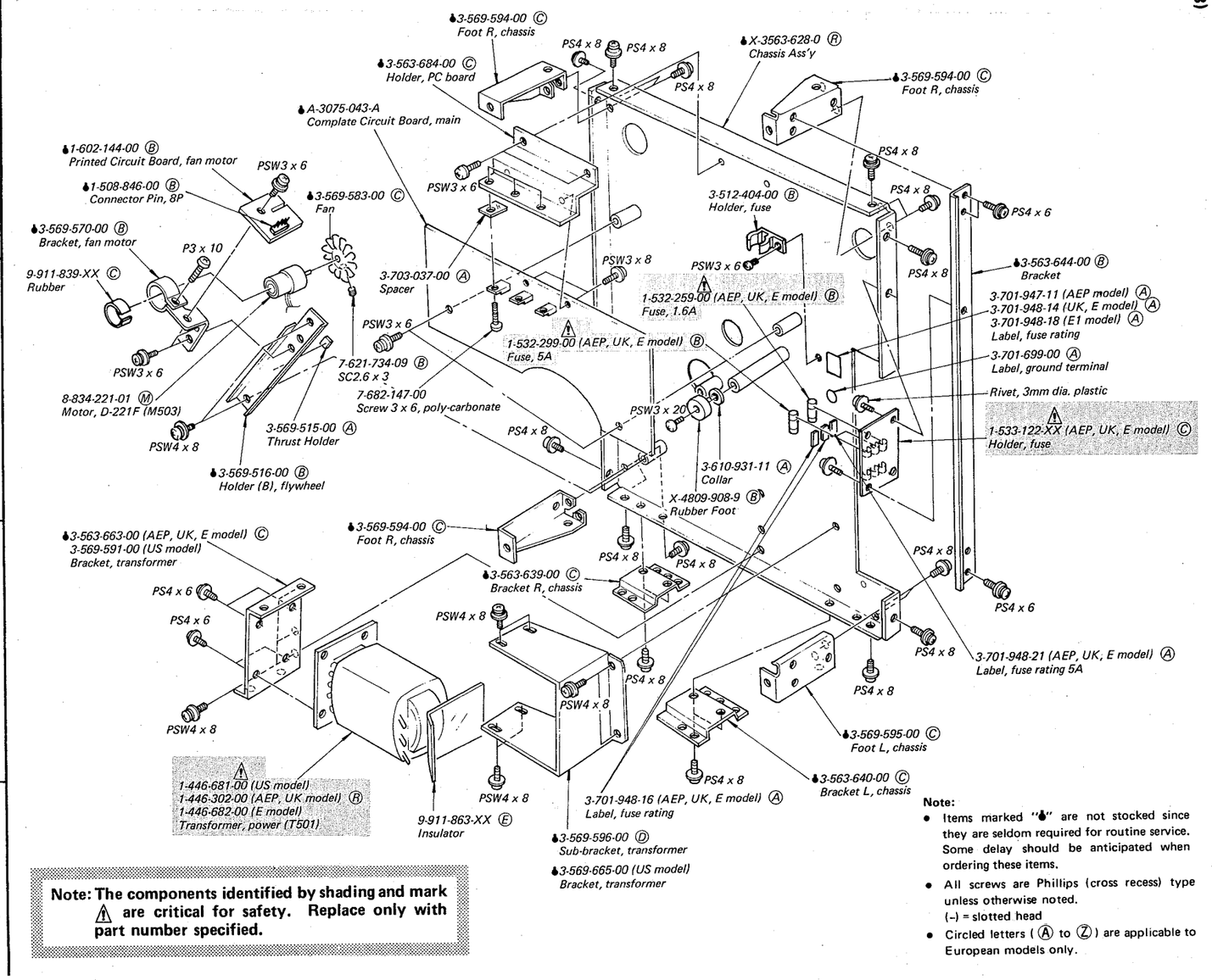
  (-) = slotted head
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.


Mounted on connector board
♦1-508-849-00 (B) Connector Pin, 8P
♦1-508-736-00 (B) Connector Pin, 10P
♦1-508-850-00 (B) Connector Pin, 12P
♦3-569-590-00 (C) CP Ornament
Supplied with CP ornament
Supplied with CP ornament
PSW4 x 8
♦1-602-142-00 (D) Printed Circuit Board, connector panel
♦3-563-662-00 (B) Collar
1-507-439-11 (B) Jack, HEADPHONES
1-507-251-XX (C) Jack, JM-35
Supplied with connector panel
♦A-3075-042-A Complete Circuit Board, sub
♦1-508-849-00 (B) Connector Pin, 8P
♦1-508-850-00 (B) Connector Pin, 12P
PSW3 x 6
PSW4 x 8
PSW3 x 8
1-552-141-00 (UK, AEP, E model)
1-552-133-00 (US model)
Switch, POWER
1-226-747-00 (B) Variable Resistor, 20kΩ-A
PSW3 x 6
1-509-891-00 (D) BNC Connector
PSW4 x 8
1-520-418-00 (H) Meter (ME401)
PSW 4 x 8
4-317-411-00 Cushion
1-518-115-XX (B) Lamp, 6V 35mA
PS3 x 6
♦3-569-567-00 (B) Bracket, panel
Supplied with connector panel
♦3-569-599-00 (D) Connector Panel
3-563-662-00 (B) Collar
♦3-002-407-07 (B) Collar
PS3 x 6
♦1-508-735-00 (B) Connector Pin, 5P
3-569-518-00 (B) Knob, POWER
♦3-625-095-00 (B) Holder, lamp
1-561-480-00 (E) Connector, 8P
PSW4 x 8
PSW3 x 6
PSW3 x 10
PSW3 x 6
PS3 x 6
1-509-546-00 (D) AC Socket, 3P
4-857-472-00 (A) Clamp, wire
♦1-508-736-00 (B) Connector Pin, 10P
♦1-602-143-00 (B) Printed Circuit Board, function
3-701-946-22 (US model) (A) Label, fuse rating
1-533-102-XX (B) Holder, fuse
1-532-555-00 (US model) (B)
1-532-078-00 (UK, AEP, E model) (B) Fuse
1-553-238-00 (C) Switch, push
1-553-203-00 (G) Switch, 4-key
PSW3 x 6
1-226-746-00 (D) Variable Resistor, 20kΩ/250kΩ-C (RV402)
Supplied with switch
♦3-569-601-00 (C) Panel (lower), function
♦3-569-663-00 (B) Bracket, lamp

Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

(3)


♦3-569-594-00 (C) Foot R, chassis
PS4 x 8
♦X-3563-628-0 (R) Chassis Ass'y
♦3-563-684-00 (C) Holder, PC board
♦3-569-594-00 (C) Foot R, chassis
♦A-3075-043-A Complate Circuit Board, main
♦1-602-144-00 (B) Printed Circuit Board, fan motor
PSW3 x 6
♦1-508-846-00 (B) Connector Pin, 8P
♦3-569-583-00 (C) Fan
3-512-404-00 (B) Holder, fuse
PS4 x 6
♦3-569-570-00 (B) Bracket, fan motor
P3 x 10
9-911-839-XX (C) Rubber
3-703-037-00 (A) Spacer
PSW3 x 8
♦3-563-644-00 (B) Bracket
1-532-259-00 (AEP, UK, E model) (B) Fuse, 1.6A
3-701-947-11 (AEP model) (A)
3-701-948-14 (UK, E model) (A)
3-701-948-18 (E1 model) (A) Label, fuse rating
1-532-299-00 (AEP, UK, E model) (B) Fuse, 5A
7-621-734-09 (B) SC2.6 x 3
3-701-699-00 (A) Label, ground terminal
7-682-147-00 Screw 3 x 6, poly-carbonate
Rivet, 3mm dia. plastic
PSW3 x 20
1-533-122-XX (AEP, UK, E model) (C) Holder, fuse
8-834-221-01 (M) Motor, D-221F (M503)
3-569-515-00 (A) Thrust Holder
3-610-931-11 (A) Collar
♦3-569-516-00 (B) Holder (B), flywheel
X-4809-908-9 (B) Rubber Foot
♦3-563-663-00 (AEP, UK, E model) (C) 3-569-591-00 (US model) Bracket, transformer
♦3-569-594-00 (C) Foot R, chassis
♦3-563-639-00 (C) Bracket R, chassis
PS4 x 6
PSW4 x 8
3-701-948-21 (AEP, UK, E model) (A) Label, fuse rating 5A
♦3-569-595-00 (C) Foot L, chassis
♦3-563-640-00 (C) Bracket L, chassis
1-446-681-00 (US model)
1-446-302-00 (AEP, UK model) (R)
1-446-682-00 (E model)
Transformer, power (T501)
9-911-863-XX (E) Insulator
3-701-948-16 (AEP, UK, E model) (A) Label, fuse rating
♦3-569-596-00 (D) Sub-bracket, transformer
♦3-569-665-00 (US model) Bracket, transformer

Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

Note:
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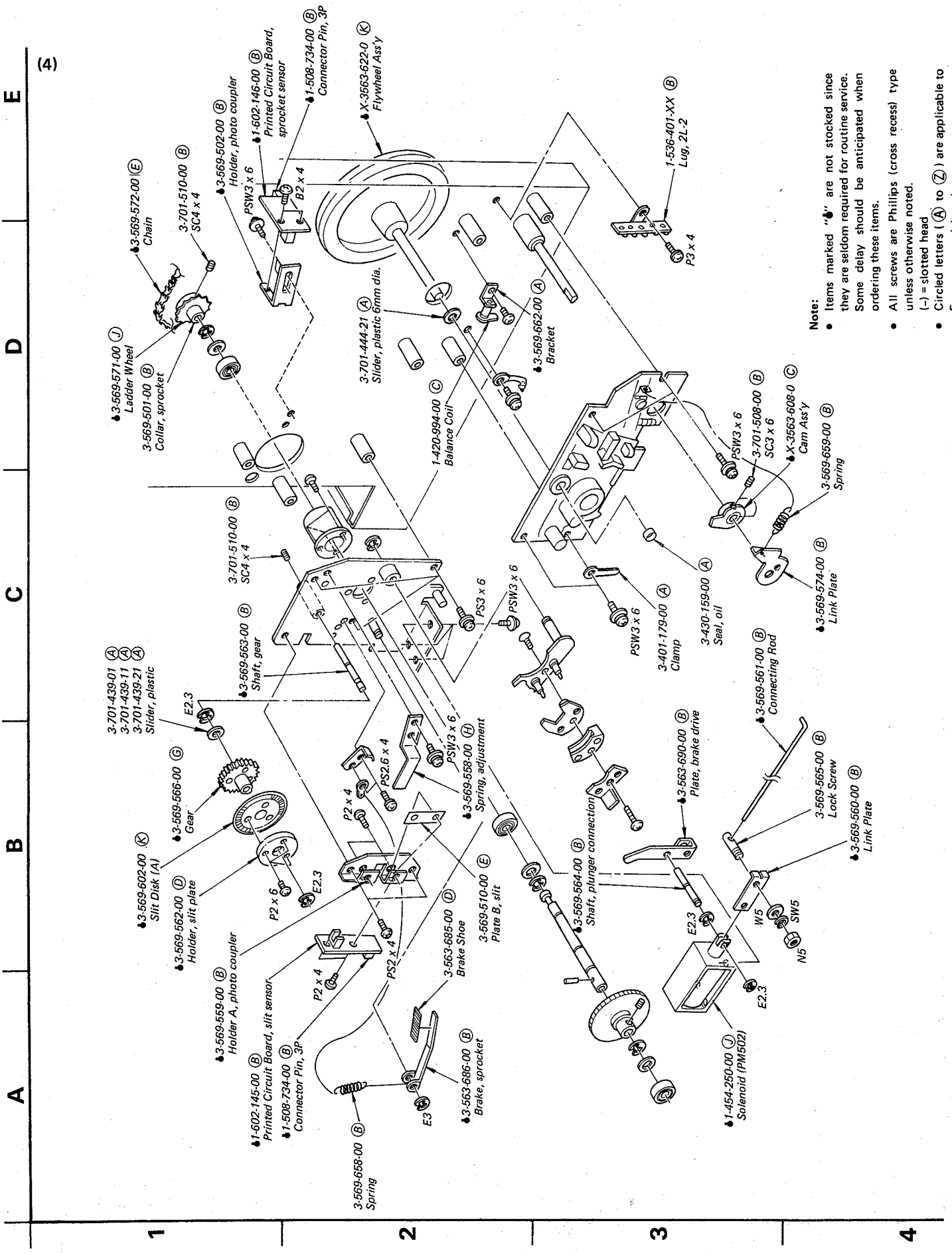
- All screws are Phillips (cross recess) type unless otherwise noted.
  (-) = slotted head
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

(4)



Note:

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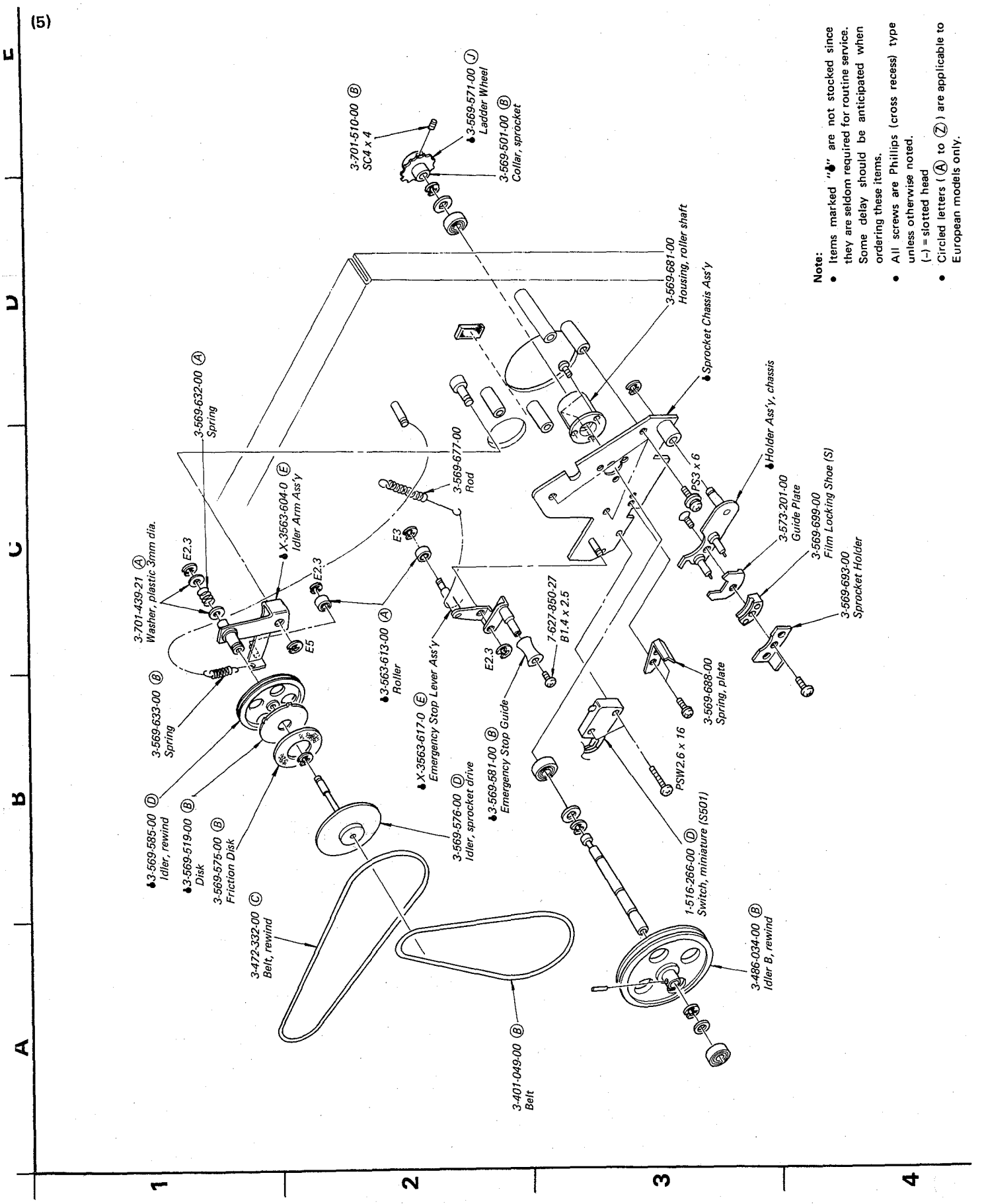
  (–) = slotted head
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

(5)



Note:

- Items marked "•" are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.
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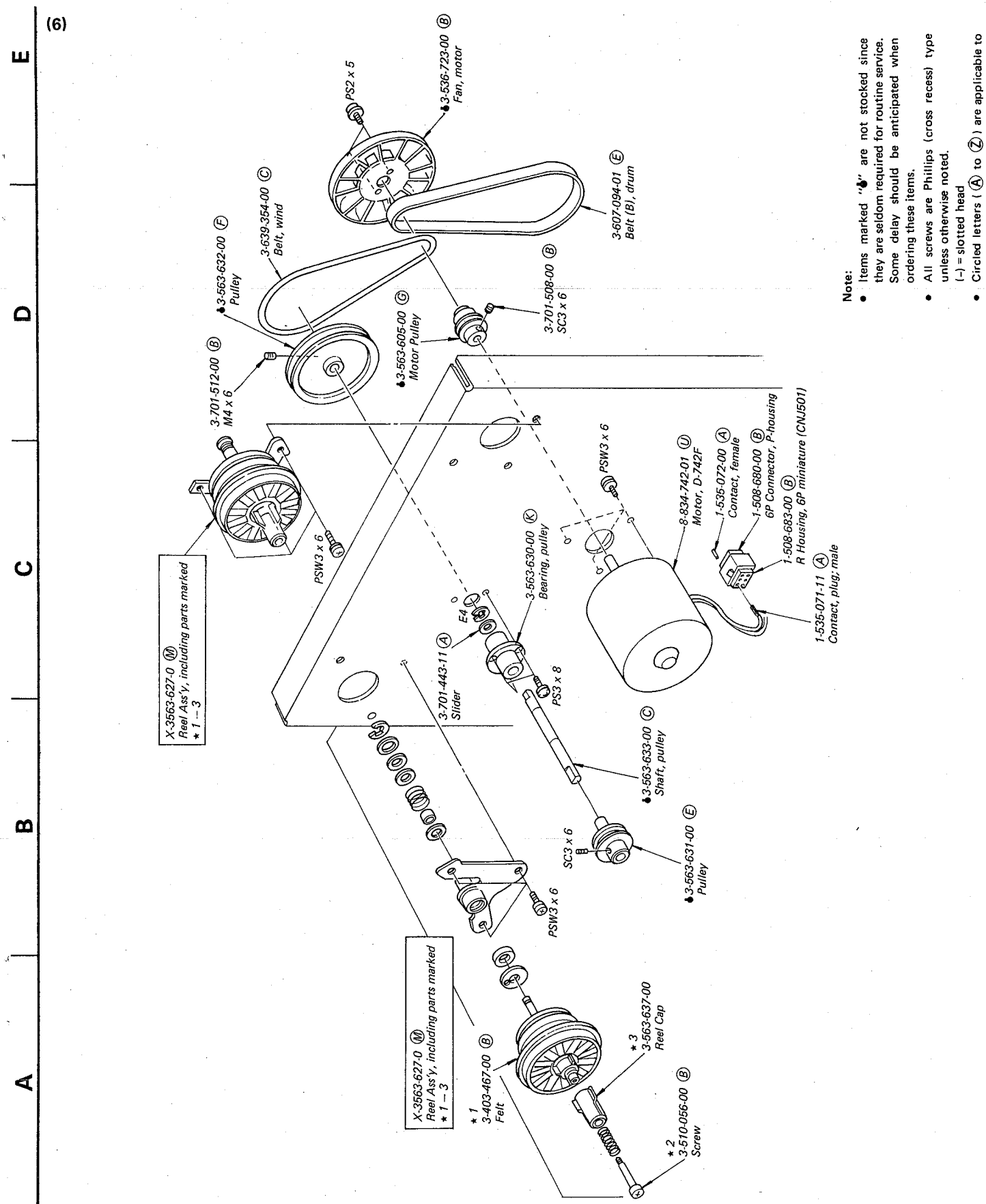
  (-) = slotted head
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

(6)



Note:

- Items marked "★" are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (-) = slotted head
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

A B C D

1 2 3 4 5

(9)

Note:

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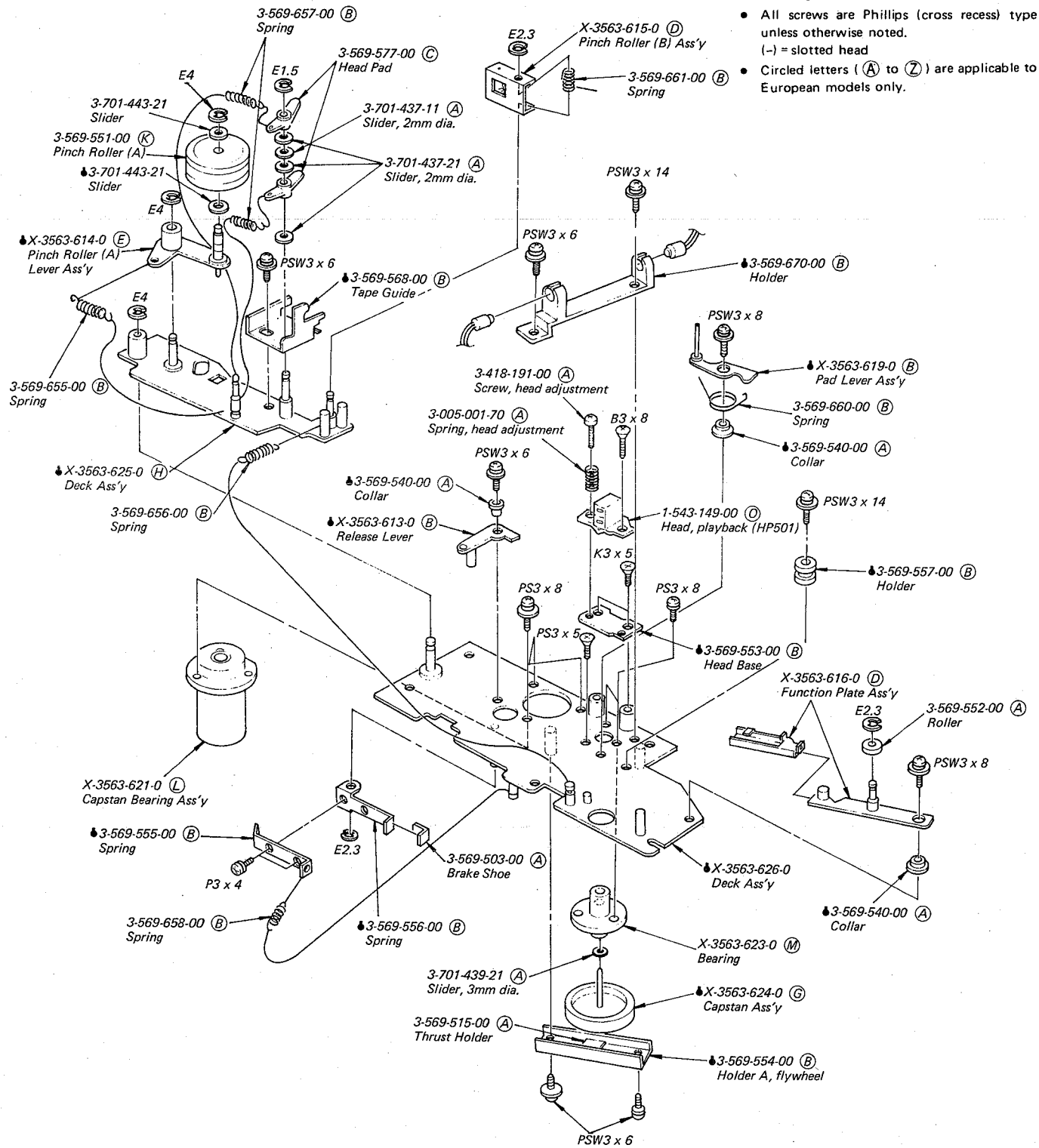
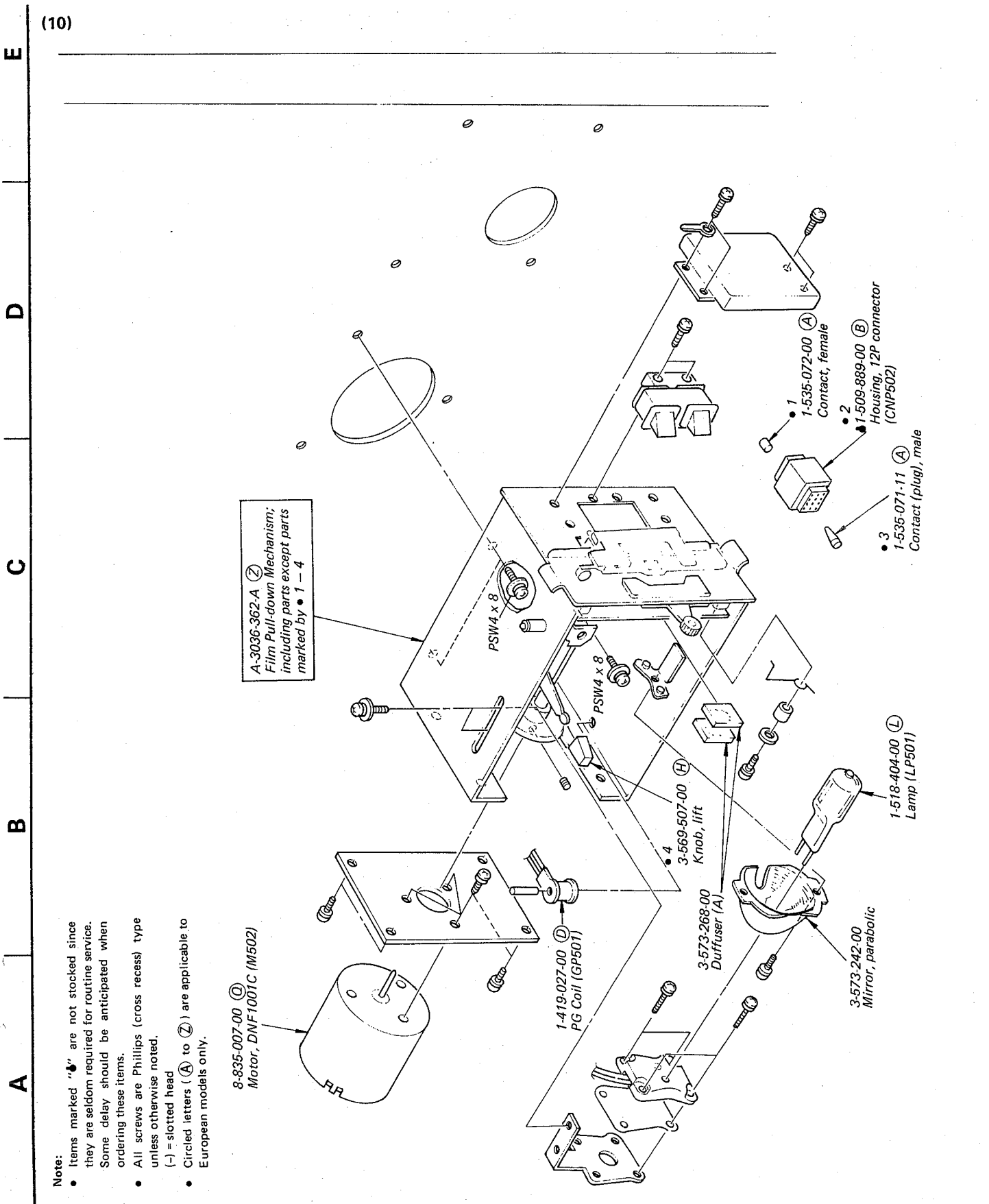
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.



(10)



Note:

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- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

SECTION 6
ELECTRICAL PARTS LIST

Note: Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

Ref. No.	*Part No.*	*Description*
		Complete Circuit Board
•	A-3075-042-A	Sub
•	A-3075-043-A	Main
		Printed Circuit Board
•	1-602-142-00	Ⓓ Connector Panel
•	1-602-143-00	Ⓑ Function Panel
•	1-602-144-00	Ⓑ Fan Motor
•	1-602-145-00	Ⓑ Slit Plate Sensor
•	1-602-146-00	Ⓑ Sprocket Sensor
		SEMICONDUCTORS
		Transistors
⇒ Q101	8-729-307-62	Ⓓ 2SD476A
Q102, 103	8-729-316-12	Ⓓ 2SC1061
Q104	8-729-663-47	Ⓑ 2SC1364
⇒ Q105	8-729-612-77	Ⓑ 2SA1027R
Q106	8-729-316-12	Ⓓ 2SC1061
Q107–115	8-729-663-47	Ⓑ 2SC1364
Q116	8-725-412-00	Ⓒ 2SC1124
Q117, 118	8-729-663-47	Ⓑ 2SC1364
Q119	8-725-412-00	Ⓒ 2SC1124
Q120–123	8-729-663-47	Ⓑ 2SC1364
⇒ Q124	8-729-612-77	Ⓑ 2SA1027R
Q125	8-729-663-47	Ⓑ 2SC1364
⇒ Q126	8-729-665-47	Ⓑ 2SC1362
Q201–203	8-729-663-47	Ⓑ 2SC1364
Q204	8-725-412-00	Ⓒ 2SC1124
Q205–207	8-729-663-47	Ⓑ 2SC1364
Q208	8-729-316-12	Ⓓ 2SC1061
⇒ Q501	8-729-206-01	Ⓕ TPS601
		ICs
IC101	8-759-271-39	Ⓒ TA7139P
IC103	8-750-690-00	Ⓓ CX069
IC104	8-759-271-40	Ⓓ TA7140P
⇒ IC106	8-759-240-13	Ⓔ TC4013BP
⇒ IC107	8-759-045-38	Ⓘ MC14538BCP
⇒ IC108	8-759-240-49	Ⓔ TC4049BP
⇒ IC201	8-759-045-72	Ⓓ MC14572UBCP
⇒ IC501, 502	8-719-902-01	Ⓓ SPI201
		Diodes
⇒ D101, 102	⚠ 8-719-911-55	Ⓒ U05G
⇒ D103	8-719-931-08	Ⓑ EQB01-08
D104, 105	8-719-815-55	Ⓑ 1S1555
⇒ D106, 107	8-719-422-21	Ⓑ 1T22AM
D108–110	8-719-815-55	Ⓑ 1S1555
⇒ D111, 112	8-719-422-21	Ⓑ 1T22AM
⇒ D113, 114	8-719-168-77	Ⓑ RD6.8E-C
D115, 116	8-719-200-02	Ⓑ 10E2
D201–204	8-719-815-55	Ⓑ 1S1555
D301	8-719-200-02	Ⓑ 10E2
⇒ D503	⚠ 8-719-200-02	Ⓑ 10E2
D504	8-719-103-01	Ⓙ SE301A
		SWITCHES
S201	1-516-785-XX	Ⓒ Slide; FILM TYPE
S301	1-553-224-00	Ⓓ Slide; FILM DRIVE CONTROL
S302	1-516-785-XX	Ⓒ Slide; VIDEO FIELD
S401–404	1-553-203-00	Ⓖ Push; STILL/18/24/VARIABLE
S405	1-553-238-00	Ⓒ Push; PAUSE
S501	1-516-266-00	Ⓓ Miniature; LOOP SAFETY
S504	1-553-242-00	Ⓗ Rotary; FUNCTION
S505	⚠ 1-552-133-00	Push, POWER (US model)
	1-552-141-00	Push, POWER (UK, AEP, E model)
		RESISTORS

All resistors are in ohms. Common ¼W carbon resistors are omitted. Check schematic diagram for values.

R121	⚠ 1-213-038-00	Ⓑ	1.2	1W	fusible
R503	1-206-644-00	Ⓑ	150	2W	metal oxide
RV101	1-224-134-XX	Ⓑ	470k-B, adjustable		
RV102, 103	1-224-253-XX	Ⓑ	22k-B, adjustable		
RV104	1-224-250-XX	Ⓑ	2.2k-B, adjustable		
RV105–108	1-224-254-XX	Ⓑ	47k-B, adjustable		
RV109	1-224-251-XX	Ⓑ	4.7k-B, adjustable		
RV201–204	1-224-253-XX	Ⓑ	22k-B, adjustable		
RV205–208	1-224-252-XX	Ⓑ	10k-B, adjustable		

⇒: Due to standardization, interchangeable replacements may be substituted for parts specified in the diagrams.

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Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

Note: Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

Ref. No.	Part No.	Description
RV209	1-224-247-XX	Ⓑ 100k-B, adjustable; LOOP SEN ADJ
RV301	1-224-251-XX	Ⓑ 4.7k-B, adjustable; TONE
RV401	1-226-747-00	Ⓑ 20k-A, variable; VOLUME
RV402	1-226-746-00	Ⓓ 20k/250k, variable; FILM SPEED FINE/VARIABLE
RV501	1-226-525-00	Ⓑ 50k-B, adjustable

MISCELLANEOUS

CN501	⚠1-509-546-00	Ⓓ AC Socket, 3P
CNJ301,302	1-509-891-00	Ⓓ BNC Connector
CNJ303	1-561-480-00	Ⓔ Connector, DIN 8P
CNJ501	1-508-683-00	Ⓑ 6P Connector
CNP501	1-508-680-00	Ⓑ 6P Connector, P-housing
CNP502	♦ 1-509-889-00	Ⓑ 12P Connector Housing
CP101	1-231-325-00	Ⓒ Encapsulated Component
CP401	⚠1-231-325-00	Encapsulated Component (US model)
CP401	⚠1-130-456-00	Ⓒ Encapsulated Component (AEP, UK, E model)
F501	⚠1-532-555-00	Fuse (US model)
F501	⚠1-532-078-00	Ⓑ Fuse (AEP, UK, E model)
F502	⚠1-532-299-00	Ⓑ Fuse, 5A
F503, 504	⚠1-532-259-00	Ⓑ Fuse, 1.6A
HP501	1-543-149-00	Ⓞ Head, playback
J301	1-507-439-11	Ⓑ Jack, HEADPHONES
J302	1-507-251-XX	Ⓒ Jack, JM-35
L501, 502	1-421-486-00	Ⓒ Choke Coil
L503	1-420-994-00	Ⓒ Blance Coil
LP501	1-518-404-00	Ⓛ Lamp
M501	8-834-742-01	Ⓤ DC Motor, D-742F
M502	8-835-007-00	Ⓠ Motor, DNF 1001C
M503	8-834-221-01	Ⓜ Motor, D-221F
ME401	1-520-418-00	Ⓗ Meter
PL401–404	1-518-115-XX	Ⓑ Lamp, 6V 35mA
PG501	1-419-027-00	Ⓓ PG Coil
PM502	♦ 1-454-250-00	Ⓙ Solenoid
T301	1-423-193-00	Ⓒ Transformer, input/output
T501	⚠1-446-302-00	Ⓡ Transformer, power (UK, AEP model)
T501	⚠1-446-681-00	Transformer, power (US model)
T501	⚠1-446-682-00	Transformer, power (E model)
THP101	1-800-535-00	Ⓑ Thermistor, positive
THP301	1-800-535-00	Ⓑ Thermistor, positive
TP105,106	1-508-811-00	Ⓐ Base Post
TP108,110	1-508-811-00	Ⓐ Base Post

- Items marked "♦" are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.

Ref. No.	Part No.	Description
	⚠1-533-102-XX	Ⓑ Fuse Holder
	⚠1-533-122-XX	Ⓒ Fuse Holder, 3P
	1-535-071-11	Ⓐ Contact, plug; male
	1-535-072-00	Ⓐ Contact, female
	1-536-401-XX	Ⓑ Terminal, C-type 2L2
	1-547-043-00	Ⓧ Lens

CONNECTOR PIN

CN101	♦1-508-846-00	Ⓑ 8P
CN102, 103	♦1-508-742-00	Ⓑ 3P
CN104	♦1-508-744-00	Ⓑ 10P
CN105	♦1-508-743-00	Ⓑ 5P
CN106, 107	♦1-508-846-00	Ⓑ 8P
CN108	♦1-508-744-00	Ⓑ 10P
CN109, 110	♦1-508-910-00	Ⓑ 12P
CN201	♦1-508-849-00	Ⓑ 8P
CN202	♦1-508-850-00	Ⓑ 12P
CN301, 302	♦1-508-736-00	Ⓑ 10P
CN303	♦1-508-850-00	Ⓑ 12P
CN304	♦1-508-849-00	Ⓑ 8P
CN401	♦1-508-735-00	Ⓑ 5P
CN402	♦1-508-736-00	Ⓑ 10P
CN501, 502	♦1-508-734-00	Ⓑ 3P
CN503	♦1-508-846-00	Ⓑ 8P

ACCESSORIES AND PACKING MATERIALS

Part No.	Description
♦1-506-392-00	Ⓓ Plug Adaptor, PC-5A
⚠1-534-754-00	Ⓕ Cord, power
1-551-475-41	Ⓜ Coaxial Cable Ass'y
1-551-760-00	Ⓕ Cord, connection; RK-118
3-569-580-00	Ⓘ Dust Cover
3-569-616-00	Ⓐ Sheet, protection; cord
3-569-640-00	Ⓓ Diffuser (B), frosted glass
3-569-645-00	Ⓚ Sprocket Wheel
3-569-646-00	Ⓗ Shoe, film locking
3-569-647-00	Ⓗ Wheel, sprocket
3-701-616-00	Ⓐ Bag, plastic
3-701-632-00	Ⓐ Bag, plastic
3-770-761-12	Ⓚ Manual, instruction
4-843-578-00	Ⓓ Bag, protection

Note: The components identified by shading and mark ⚠ are critical for safety. Replace only with part number specified.

ELECTROLYTIC CAPACITORS

Note: Circled letter (Ⓐ to Ⓩ) are applicable to European models only.

CAP. (μF)	RATING → : Use the high voltage rated one.					
	6.3 VOLT.	10 VOLT.	16 VOLT.	25 VOLT.	35 VOLT.	50 VOLT.
	PART No.	PART No.	PART No.	PART No.	PART No.	PART No.
0.47					→	1-121-726-00 Ⓐ
1.0					→	1-121-391-00 Ⓐ
2.2					→	1-121-450-00 Ⓐ
3.3	→	→	→	1-121-392-00 Ⓐ	→	1-121-393-00 Ⓐ
4.7	→	→	→	1-121-395-00 Ⓐ	→	1-121-396-00 Ⓐ
10	→	→	1-121-651-00 Ⓐ	1-121-398-00 Ⓐ	→	1-121-738-00 Ⓐ
22	→	→	1-121-479-00 Ⓐ	1-121-480-00 Ⓐ	1-121-662-00 Ⓐ	1-121-152-00 Ⓐ
33	→	→	1-121-403-00 Ⓐ	1-121-404-00 Ⓐ	1-121-652-00 Ⓑ	1-121-405-00 Ⓐ
47	→	1-121-352-00 Ⓐ	1-121-409-00 Ⓐ	1-121-410-00 Ⓐ	1-121-653-00 Ⓑ	1-121-411-00 Ⓐ
100	→	1-121-414-00 Ⓐ	1-121-415-00 Ⓐ	1-121-416-00 Ⓐ	1-121-357-00 Ⓑ	1-121-417-00 Ⓑ
220	1-121-419-00 Ⓑ	1-121-420-00 Ⓑ	1-121-421-00 Ⓐ	1-121-422-00 Ⓑ	1-121-261-00 Ⓒ	1-121-423-00 Ⓑ
330	1-121-751-00 Ⓑ	1-121-805-00 Ⓑ	1-121-521-00 Ⓒ	1-121-654-00 Ⓑ	1-121-655-00 Ⓓ	1-121-656-00 Ⓒ
470	1-121-424-00 Ⓑ	1-121-425-00 Ⓒ	1-121-426-00 Ⓒ	1-121-733-00 Ⓑ	1-121-361-00 Ⓔ	1-121-810-00 Ⓓ
1000	–	1-121-736-00 Ⓒ	1-121-245-00 Ⓓ	1-121-657-00 Ⓓ	1-121-388-00 Ⓔ	1-123-061-00 Ⓕ
2200	1-121-658-00 Ⓑ	1-121-659-00 Ⓒ	1-121-660-00 Ⓓ	1-123-067-00 Ⓕ	1-121-984-00 Ⓕ	–
3300	1-121-661-00 Ⓓ	1-123-075-00 Ⓔ	1-123-071-00 Ⓕ	–	–	–

CAP. (μF)	100 VOLT.	160 VOLT.	250 VOLT.	350 VOLT.
	PART No.	PART No.	PART No.	PART No.
0.47	–	–	–	–
1.0	1-123-249-00 Ⓐ	1-123-252-00 Ⓐ	1-123-003-00 Ⓑ	1-121-168-00 Ⓑ
2.2	1-123-250-00 Ⓐ	1-123-026-00 Ⓑ	–	1-123-028-00 Ⓑ
3.3	1-121-995-00 Ⓐ	–	1-123-004-00 Ⓑ	1-123-006-00 Ⓒ
4.7	1-123-255-00 Ⓐ	1-121-246-00 Ⓑ	1-121-759-00 Ⓑ	1-123-007-00 Ⓓ
10	1-121-126-00 Ⓑ	1-121-999-00 Ⓑ	1-123-254-00 Ⓒ	1-123-008-00 Ⓓ
22	1-121-996-00 Ⓒ	1-123-253-00 Ⓒ	1-123-005-00 Ⓓ	1-123-022-00 Ⓓ
33	1-121-997-00 Ⓒ	1-121-757-00 Ⓒ	–	–
47	1-123-251-00 Ⓒ	1-121-919-00 Ⓒ	–	–
100	1-123-084-00 Ⓔ	–	–	–

CERAMIC CAPACITORS Ⓐ

CAP. (pF)	RATING 50 VOLT. PART No.	CAP. (pF)	50 VOLT. PART No.	CAP. (pF)	50 VOLT. PART No.	CAP. (μF)	50 VOLT. PART No.
0.5	1-101-837-00	22	1-102-959-00	150	1-101-361-00	0.001	1-102-074-00
0.75	1-101-586-00	24	1-102-960-00	160	1-101-367-00	0.0012	1-102-118-00
1.0	1-102-934-00	27	1-102-961-00	180	1-102-976-00	0.0015	1-102-119-00
1.5	1-101-576-00	30	1-102-962-00	200	1-102-977-00	0.0018	1-102-120-00
2.0	1-102-935-00	33	1-102-963-00	220	1-102-978-00	0.0022	1-102-121-00
3	1-102-936-00	36	1-102-964-00	240	1-102-979-00	0.0027	1-102-122-00
4	1-102-937-00	39	1-102-965-00	270	1-102-980-00	0.0033	1-102-123-00
5	1-102-942-00	43	1-102-966-00	300	1-102-981-00	0.0039	1-102-124-00
6	1-102-943-00	47	1-101-880-00	330	1-102-820-00	0.0047	1-102-125-00
7	1-102-944-00	51	1-101-882-00	360	1-102-821-00	0.0056	1-102-126-00
8	1-102-945-00	56	1-101-884-00	390	1-102-822-00	0.0068	1-102-127-00
9	1-102-946-00	62	1-101-886-00	430	1-102-823-00	0.0082	1-102-128-00
10	1-102-947-00	68	1-101-888-00	470	1-102-824-00	0.01	1-102-129-00
11	1-102-948-00	75	1-101-890-00	510	1-101-059-00	0.022	1-101-005-00
12	1-102-949-00	82	1-102-971-00	560	1-102-115-00	0.047	1-101-006-00
13	1-102-950-00	91	1-102-972-00	680	1-102-116-00		
15	1-102-951-00	100	1-102-973-00	820	1-102-117-00		
16	1-102-952-00	110	1-102-815-00				
18	1-102-953-00	120	1-102-816-00				
20	1-102-958-00	130	1-101-081-00				

0.001μF = 1,000pF

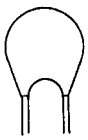
CERAMIC (SEMICONDUCTOR) CAPACITORS Ⓐ

CAP. (μF)	RATING → : Use the high voltage rated one. 25 VOLT. PART No.	50 VOLT. PART No.	CAP. (μF)	25 VOLT. PART No.	50 VOLT. PART No.
0.001	→	1-161-039-00	0.018	1-161-016-00	1-161-054-00
0.0012	→	1-161-040-00	0.022	1-161-017-00	1-161-055-00
0.0015		1-161-041-00	0.027	1-161-018-00	1-161-056-00
0.0018		1-161-042-00	0.033	1-161-019-00	1-161-057-00
0.0022		1-161-043-00	0.039	1-161-010-00	1-161-058-00
0.0027	→	1-161-044-00	0.047	1-161-021-00	1-161-059-00
0.0033	→	1-161-045-00	0.056	→	1-161-060-00
0.0039	→	1-161-046-00	0.068	→	1-161-061-00
0.0047	→	1-161-047-00	0.082	1-161-024-00	1-161-062-00
0.0056	→	1-161-048-00	0.1	1-161-025-00	1-161-063-00
0.0068	→	1-161-049-00			
0.0082	1-161-012-00	1-161-050-00			
0.01	1-161-013-00	1-161-051-00			
0.012	→	1-161-052-00			
0.015	1-161-015-00	1-161-053-00			

MYLAR CAPACITORS Ⓐ

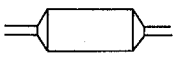
Note: Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

CAP. (μF)	RATING 50 VOLT. PART No.	100 VOLT. PART No.	200 VOLT. PART No.	CAP. (μF)	50 VOLT. PART No.	100 VOLT. PART No.	200 VOLT. PART No.	CAP. (μF)	50 VOLT. PART No.	100 VOLT. PART No.	200 VOLT. PART No.
0.001	1-108-227-00	1-108-365-00	1-108-409-00	0.01	1-108-239-00	1-108-377-00	1-108-421-00	0.1	1-108-251-00	1-108-389-00	1-108-433-00
0.0012	1-108-351-00	1-108-366-00	1-108-410-00	0.012	1-108-357-00	1-108-378-00	1-108-422-00	0.12	1-108-363-00	1-108-390-00	1-108-434-00
0.0015	1-108-228-00	1-108-367-00	1-108-411-00	0.015	1-108-240-00	1-108-379-00	1-108-423-00	0.15	1-108-252-00	1-108-391-00	1-108-435-00
0.0018	1-108-352-00	1-108-368-00	1-108-412-00	0.018	1-108-358-00	1-108-380-00	1-108-424-00	0.18	1-108-364-00	1-108-392-00	1-108-436-00
0.0022	1-108-230-00	1-108-369-00	1-108-413-00	0.022	1-108-242-00	1-108-381-00	1-108-425-00	0.22	1-108-254-00	1-108-393-00	1-108-437-00
0.0027	1-108-353-00	1-108-370-00	1-108-414-00	0.027	1-108-359-00	1-108-382-00	1-108-426-00	0.27	1-108-854-00	–	–
0.0033	1-108-232-00	1-108-371-00	1-108-415-00	0.033	1-108-244-00	1-108-383-00	1-108-427-00	0.33	1-108-855-00	–	–
0.0039	1-108-354-00	1-108-372-00	1-108-416-00	0.039	1-108-360-00	1-108-384-00	1-108-428-00	0.39	1-108-856-00	–	–
0.0047	1-108-234-00	1-108-373-00	1-108-417-00	0.047	1-108-246-00	1-108-385-00	1-108-429-00	0.47	1-108-857-00	–	–
0.0056	1-108-355-00	1-108-374-00	1-108-418-00	0.056	1-108-361-00	1-108-386-00	1-108-430-00				
0.0068	1-108-237-00	1-108-375-00	1-108-419-00	0.068	1-108-249-00	1-108-387-00	1-108-431-00				
0.0082	1-108-356-00	1-108-376-00	1-108-420-00	0.082	1-108-362-00	1-108-388-00	1-108-432-00				



TANTALUM CAPACITORS

CAP. (μF)	RATING 3.15 VOLT. PART No.	6.3 VOLT. PART No.	10 VOLT. PART No.	16 VOLT. PART No.	20 VOLT. PART No.	25 VOLT. PART No.	35 VOLT. PART No.
	→: Use the high voltage rated one.						
0.01					→	→	1-131-396-00 Ⓑ
0.015						→	1-131-397-00 Ⓑ
0.022						→	1-131-398-00 Ⓑ
0.033						→	1-131-399-00 Ⓑ
0.047						→	1-131-400-00 Ⓑ
0.068					→	→	1-131-401-00 Ⓑ
0.1					→	→	1-131-402-00 Ⓑ
0.15					→	→	1-131-403-00 Ⓑ
0.22					→	→	1-131-404-00 Ⓑ
0.33					→	1-131-409-00 Ⓑ	1-131-405-00 Ⓑ
0.47	–	–	–	–	1-131-412-00 Ⓑ	→	1-131-406-00 Ⓑ
0.68	–	–	–	1-131-415-00 Ⓑ	→	1-131-410-00 Ⓑ	1-131-407-00 Ⓑ
1.0	–	–	1-131-418-00 Ⓑ	–	1-131-413-00 Ⓑ	→	1-131-408-00 Ⓑ
1.5	–	1-131-421-00 Ⓑ	–	1-131-416-00 Ⓑ	→	1-131-411-00 Ⓑ	1-131-348-00 Ⓑ
2.2	1-131-424-00 Ⓑ	–	1-131-419-00 Ⓑ	–	1-131-414-00 Ⓑ	1-131-355-00 Ⓑ	1-131-349-00 Ⓑ
3.3	–	1-131-422-00 Ⓑ	–	1-131-417-00 Ⓑ	1-131-362-00 Ⓑ	1-131-356-00 Ⓑ	1-131-350-00 Ⓑ
4.7	1-131-425-00 Ⓑ	–	1-131-420-00 Ⓑ	1-131-369-00 Ⓑ	1-131-363-00 Ⓑ	1-131-357-00 Ⓑ	1-131-351-00 Ⓒ
6.8	–	1-131-423-00 Ⓑ	1-131-376-00 Ⓑ	1-131-370-00 Ⓑ	1-131-364-00 Ⓑ	1-131-358-00 Ⓒ	1-131-352-00 Ⓒ
10	1-131-426-00 Ⓑ	1-131-383-00 Ⓑ	1-131-377-00 Ⓑ	1-131-371-00 Ⓑ	1-131-365-00 Ⓒ	1-131-359-00 Ⓒ	1-131-353-00 Ⓓ
15	1-131-390-00 Ⓑ	1-131-384-00 Ⓑ	1-131-378-00 Ⓑ	1-131-372-00 Ⓑ	1-131-366-00 Ⓒ	1-131-360-00 Ⓓ	–
22	1-131-391-00 Ⓑ	1-131-385-00 Ⓑ	1-131-379-00 Ⓒ	1-131-373-00 Ⓒ	1-131-367-00 Ⓓ		
33	1-131-392-00 Ⓑ	1-131-386-00 Ⓒ	1-131-380-00 Ⓒ	1-131-374-00 Ⓓ			
47	1-131-393-00 Ⓒ	1-131-387-00 Ⓒ	1-131-381-00 Ⓓ	–			
68	1-131-394-00 Ⓑ	1-131-388-00 Ⓒ	–	–			
100	1-131-395-00 Ⓓ	–	–	–			



TANTALUM CAPACITORS

CAP. (μF)	RATING 3 VOLT. PART No.	6.3 VOLT. PART No.	10 VOLT. PART No.	16 VOLT. PART No.	20 VOLT. PART No.	35 VOLT. PART No.
0.033						1-131-273-00 Ⓔ
0.047						1-131-274-00 Ⓔ
0.068						1-131-275-00 Ⓔ
0.1						1-131-276-00 Ⓓ
0.15						1-131-277-00 Ⓓ
0.22			–	–	1-131-262-00 Ⓓ	1-131-278-00 Ⓓ
0.33			–	–	1-131-263-00 Ⓓ	1-131-279-00 Ⓓ
0.47			1-131-169-00 Ⓓ	–	1-131-264-00 Ⓓ	1-131-280-00 Ⓓ
0.68			–	1-131-258-00 Ⓓ	1-131-265-00 Ⓓ	1-131-281-00 Ⓓ
1.0			1-131-254-00 Ⓓ	–	1-131-266-00 Ⓓ	1-131-282-00 Ⓓ
1.5		1-131-250-00 Ⓓ	–	–	1-131-267-00 Ⓓ	1-131-283-00 Ⓔ
2.2		–	–	1-131-259-00 Ⓓ	1-131-268-00 Ⓓ	1-131-284-00 Ⓔ
3.3		–	1-131-255-00 Ⓓ	–	1-131-269-00 Ⓓ	–
4.7		1-131-251-00 Ⓔ	1-131-171-00 Ⓓ	–	1-131-270-00 Ⓓ	–
6.8		–	–	1-131-260-00 Ⓓ	1-131-271-00 Ⓔ	–
10	–	–	1-131-256-00 Ⓓ	–	1-131-272-00 Ⓔ	–
15	–	1-131-252-00 Ⓓ	–	1-131-261-00 Ⓔ		
22	–	–	1-131-257-00 Ⓔ	–		
33	1-131-176-00 Ⓓ	1-131-253-00 Ⓔ	1-131-173-00 Ⓒ	–		
47	1-131-288-00 Ⓕ	1-131-174-00 Ⓓ	–	–		
100	1-131-177-00 Ⓓ					

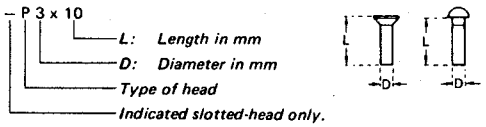
1/4 WATT CARBON RESISTORS Ⓐ

Note: Circled letter Ⓐ is applicable to European models only.

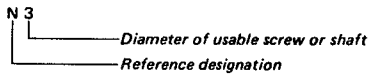
Ω	*Part No.*	Ω	*Part No.*	Ω	*Part No.*	Ω	*Part No.*	Ω	*Part No.*	Ω	*Part No.*	Ω	*Part No.*
1.0	1-246-401-00	10	1-246-425-00	100	1-246-449-00	1.0k	1-246-473-00	10k	1-246-497-00	100k	1-246-521-00	1.0M	1-246-545-00
1.1	1-246-402-00	11	1-246-426-00	110	1-246-450-00	1.1k	1-246-474-00	11k	1-246-498-00	110k	1-246-522-00	1.1M	1-210-814-00
1.2	1-246-403-00	12	1-246-427-00	120	1-246-451-00	1.2k	1-246-475-00	12k	1-246-499-00	120k	1-246-523-00	1.2M	1-210-815-00
1.3	1-246-404-00	13	1-246-428-00	130	1-246-452-00	1.3k	1-246-576-00	13k	1-246-500-00	130k	1-246-524-00	1.3M	1-210-816-00
1.5	1-246-405-00	15	1-246-429-00	150	1-246-453-00	1.5k	1-246-577-00	15k	1-246-501-00	150k	1-246-525-00	1.5M	1-210-817-00
1.6	1-246-406-00	16	1-246-430-00	160	1-246-454-00	1.6k	1-246-578-00	16k	1-246-502-00	160k	1-246-526-00	1.6M	1-210-818-00
1.8	1-246-407-00	18	1-246-431-00	180	1-246-455-00	1.8k	1-246-579-00	18k	1-246-503-00	180k	1-246-527-00	1.8M	1-210-819-00
2.0	1-246-408-00	20	1-246-432-00	200	1-246-456-00	2.0k	1-246-580-00	20k	1-246-504-00	200k	1-246-528-00	2.0M	1-210-820-00
2.2	1-246-409-00	22	1-246-433-00	220	1-246-457-00	2.2k	1-246-581-00	22k	1-246-505-00	220k	1-246-529-00	2.2M	1-210-821-00
2.4	1-246-410-00	24	1-246-434-00	240	1-246-458-00	2.4k	1-246-582-00	24k	1-246-506-00	240k	1-246-530-00	2.4M	1-244-754-00
2.7	1-246-411-00	27	1-246-435-00	270	1-246-459-00	2.7k	1-246-583-00	27k	1-246-507-00	270k	1-246-531-00	2.7M	1-244-755-00
3.0	1-246-412-00	30	1-246-436-00	300	1-246-460-00	3.0k	1-246-584-00	30k	1-246-508-00	300k	1-246-532-00	3.0M	1-244-756-00
3.3	1-246-413-00	33	1-246-437-00	330	1-246-461-00	3.3k	1-246-585-00	33k	1-246-509-00	330k	1-246-533-00	3.3M	1-244-757-00
3.6	1-246-414-00	36	1-246-438-00	360	1-246-462-00	3.6k	1-246-586-00	36k	1-246-510-00	360k	1-246-534-00	3.6M	1-244-758-00
3.9	1-246-415-00	39	1-246-439-00	390	1-246-463-00	3.9k	1-246-587-00	39k	1-246-511-00	390k	1-246-535-00	3.9M	1-244-759-00
4.3	1-246-416-00	43	1-246-440-00	430	1-246-464-00	4.3k	1-246-488-00	43k	1-246-512-00	430k	1-246-536-00	4.3M	1-244-760-00
4.7	1-246-417-00	47	1-246-441-00	470	1-246-465-00	4.7k	1-246-489-00	47k	1-246-513-00	470k	1-246-537-00	4.7M	1-244-761-00
5.1	1-246-418-00	51	1-246-442-00	510	1-246-466-00	5.1k	1-246-490-00	51k	1-246-514-00	510k	1-246-538-00	5.1M	1-244-762-00
5.6	1-246-419-00	56	1-246-443-00	560	1-246-467-00	5.6k	1-246-491-00	56k	1-246-515-00	560k	1-246-539-00		
6.2	1-246-420-00	62	1-246-444-00	620	1-246-468-00	6.2k	1-246-492-00	62k	1-246-516-00	620k	1-246-540-00		
6.8	1-246-421-00	68	1-246-445-00	680	1-246-469-00	6.8k	1-246-493-00	68k	1-246-517-00	680k	1-246-541-00		
7.5	1-246-422-00	75	1-246-446-00	750	1-246-470-00	7.5k	1-246-494-00	75k	1-246-518-00	750k	1-246-542-00		
8.2	1-246-423-00	82	1-246-447-00	820	1-246-471-00	8.2k	1-246-495-00	82k	1-246-519-00	820k	1-246-543-00		
9.1	1-246-424-00	91	1-246-448-00	910	1-246-472-00	9.1k	1-246-496-00	91k	1-246-520-00	910k	1-246-544-00		

HARDWARE NOMENCLATURE

Screw:



Nut, Washer, Retaining ring:



Reference Designation	Shape	Description	Remarks
SCREWS			
P		pan-head screw	binding-head (B) screw for replacement
PWH		pan-head screw with washer face	binding-head (B) screw and flat washer for replacement
PS PSP		pan-head screw with spring washer	binding-head (B) screw and spring washer for replacement
PSW PSPW		pan-head screw with spring and flat washers	binding-head (B) screw and spring and flat washers for replacement
R		round-head screw	binding-head (B) screw for replacement
K		flat-countersunk-head screw	
RK		oval-countersunk-head screw	
B		binding-head screw	
T		truss-head screw	binding-head (B) screw for replacement
F		flat-fillister-head screw	
RF		fillister-head screw	
BV		braizer-head screw	

Reference Designation	Shape	Description	Remarks
SELF-TAPPING SCREWS			
TA		self-tapping screw	ex: TA, P 3 x 10
PTP		pan-head self-tapping screw	binding-head self-tapping (TA, B) screw for replacement
PTPWH		pan-head self-tapping screw with washer face	binding-head self tapping (TA, B) screw and flat washer for replacement
PTTWH	Ⓐ	pan-head thread-rolling screw with washer face	binding-head (B) screw and flat washer for replacement
SET SCREWS			
SC		set screw	
SC		hexagon-socket set screw	ex: SC 2.6 x 4, hexagon socket
NUT			
N		nut	
WASHERS			
W		flat washer	
SW		spring washer	
LW		internal-tooth lock washer	ex: LW3, internal
LW		external-tooth lock washer	ex: LW3, external
RETAINING RINGS			
E		retaining ring	
G		grip-type retaining ring	

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